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AVIATION SAFETY LETTER

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*Learn from the mistakes of others;
you'll not live long enough to make them all yourself...*



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Letters with comments and suggestions are invited. All correspondence should include the author's name, address and telephone number. The editor reserves the right to edit all published articles. The author's name and address will be withheld from publication upon request.

Please address your correspondence to:

Paul Marquis, Editor
Aviation Safety Letter
 Transport Canada (AARTT)
 330 Sparks Street, Ottawa ON K1A 0N8
 E-mail: paul.marquis@tc.gc.ca
 Tel.: 613-990-1289 / Fax: 613-952-3298
 Internet: www.tc.gc.ca/ASL-SAN

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The "New" Policy and Regulatory Services Branch

I am pleased to be invited to communicate with you as the relatively new director of the Policy and Regulatory Services Branch in Transport Canada Civil Aviation (TCCA). Not only am I a new director, but also in many ways this is a new Branch, built on the foundation of the former Regulatory Services Branch. As part of the Civil Aviation re-organization, the Aviation Enforcement Division moved to the Standards Branch; the Aviation Safety Analysis Division was transferred to this branch from the System Safety Branch; and a new division, Aviation Safety Policy, was established. These divisions joined the existing divisions: Regulatory Affairs, which administers the Canadian Aviation Regulation Advisory Council (CARAC), and Advisory and Appeals (Transportation Appeal Tribunal of Canada [TATC]), which provides legal advice to Civil Aviation.



Nicole Girard

The specialists in this branch provide a variety of expertise to support Civil Aviation in regulating aviation activity in Canada. Since many readers are already familiar with the rulemaking and legal aspects, I will concentrate on the new additions to the Branch to illustrate the new ways we are able to serve you.

The key activities of the Aviation Safety Policy Division are:

- Strategic visioning;
- Policy planning;
- Policy analysis;
- Policy liaison and consultation;
- Risk analysis and cost/benefit analysis;
- Policy determination.

The purpose of engaging in these activities is to ensure that Civil Aviation's direction is based on a solid understanding of the operational, economic, technological, and social conditions that affect aviation. This division gathers information on conditions, methods and techniques both internally and outside Transport Canada. Specialists sift through the details and provide senior management with the understanding they need to establish directions for managing safety risks to acceptable levels.

The Aviation Safety Policy Division works closely with the Aviation Safety Analysis Division.

The Aviation Safety Analysis Division's key activities are:

- Statistical analysis;
- Occurrence response;
- Human factors.

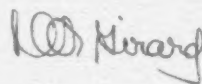
As previously mentioned, we believe that safety is achieved by managing risks to acceptable levels. The Aviation Safety Analysis Division identifies the hazards and conditions that can lead to loss or harm, and explains how these hazards lead to loss. Statistical analysts examine accident and incident data to give us a picture of the overall safety health of the system and find relationships related to the risks. They manage the Civil Aviation Daily Occurrence Reporting System (CADORS) and have access to several other Canadian and international databases.

Occurrence response specialists liaise with the Transportation Safety Board of Canada (TSB) to quickly obtain information from ongoing accident and incident investigations. In the case of a Canadian-registered aircraft or a Canadian-manufactured product (aircraft, engine, etc.) involved in accidents that occur abroad, the TSB provides TCCA specialists access to the national authority investigating the accident.

It is often said that the majority of accidents result from human error. Such thinking is an oversimplification. To understand the human performance issues related to safety, human factors specialists use the latest in human behavioural science to understand how people interact with their environment, including the mission, equipment, weather, procedures training, and human capabilities and limitations.

The statisticians, occurrence response specialists, and human factors specialists work together with engineers, pilots, maintenance specialists and air traffic specialists to understand the hazards and processes that bring about loss. In this way, the Aviation Safety Analysis Division informs policy developers and TCCA management in decision-making.

We have a strong team and sound processes to help TCCA and the aviation community advance safety. If knowledge is power, this branch is prepared to make a big contribution to the knowledge and understanding we all need to maintain Canada's excellent record and reputation for safe aviation.



Nicole Girard
Director, Policy and Regulatory Services

Vitorio Stana: 2010 Transport Canada Aviation Safety Award Recipient

On February 23, 2010, the Canada Aviation Museum hosted a reception to celebrate National Aviation Day.

During the reception, Martin J. Eley, Director General of Civil Aviation, presented the Transport Canada Aviation Safety Award to Vitorio Stana, Director of Quality Assurance at Avcorp Industries Inc., to honour his commitment to excellence in aviation safety in Canada. Mr. Stana has played a key role in setting and maintaining the highest manufacturing safety standards for Avcorp's aviation products destined for service in Canada and around the world.

Before an audience of industry and government leaders, Mr. Eley praised Mr. Stana's contribution to safety. "This year's honouree, Mr. Vitorio Stana, is one of the faces on the front line who personally works to make our industry safer. This is no small feat. On behalf of the men and women whose lives he has touched and the rest of us who reap the rewards of safer skies, I wanted to impart my sincere gratitude to Mr. Stana."

In a statement earlier that day, John Baird, Canada's Transport Minister, said "Mr. Stana's commitment to aviation safety represents the gold standard to all who work in this industry, and his thoroughness and dedication can set a good example for the young people who will follow in his footsteps."

The Transport Canada Aviation Safety Award recognizes persons, groups, companies, organizations, agencies or departments that have contributed, in an exceptional way, to aviation safety in Canada. Visit www.tc.gc.ca/aviation-safety-award to learn more about this prestigious award or to find out how to submit a nomination.

In 2009, February 23 was designated as National Aviation Day in Canada. This occasion highlights the federal government's role in the safety and security of all Canadians, and celebrates the successes of the aviation industry in Canada. △



Martin J. Eley, Director General, Civil Aviation (left) presents Vitorio Stana of Avcorp Industries Inc. (right) with the Transport Canada Aviation Safety Award at the National Aviation Day reception held at the Canada Aviation Museum in Ottawa.



TO THE LETTER

Changing the geometry of a potential collision course

I just read the excellent article "Mid-Air Collision Avoidance While Flying" by Dave Loveman in *Aviation Safety Letter* (ASL) 1/2010, and I'd like to add a couple of points that I gleaned as a Royal Canadian Air Force interceptor pilot. Those of you who routinely fly aircraft with autopilots coupled to a GPS, take note!

The earmark of a collision course is that the angle between the aircraft about to collide remains constant and there is NO relative motion to attract your attention. An approaching aircraft that is drifting up, down, left or right in your window will be a lot easier to detect and you aren't likely to collide! The danger with a true collision course is that it is very difficult to detect because the spot on the window is "frozen" and simply gets bigger and bigger until you hit it! The same phenomenon happens in the cockpit of the other aircraft as well.

What I try to do, particularly when flying cross-country, is avoid flying on a constant heading for more than a few minutes. I will alter my heading either left or right for a moment and then return. It gives me comfort to imagine that I've changed the geometry of a potential collision course. True, by "jinking" I may have just created a collision course, but hopefully my erratic flight will have caught the attention of the other pilots.

As a curiosity test, the next time you're the passenger of a car driving in open country, try putting your finger over a converging vehicle and note the angular change.

George Porayko
St. Andrews, Man.

Flight test stress

I have been a professional pilot for many years and accumulated thousands of flying hours, both military and

commercial. During my career, like all my colleagues, I was required to pass numerous written exams and flight tests. These are required to obtain the various licences and ratings needed not only to earn a living as a professional pilot but also to fly all types of private and recreational aircraft.

In conversations with other pilots and colleagues, it became clear that very few people enjoy flight tests. During a flight test, our abilities and knowledge are being put under a microscope. Even at the best of times, it can be difficult for some of us to relax and demonstrate our knowledge and proficiency under this kind of stress. Fortunately, most flight test examiners are fair and make you feel relaxed and comfortable. However, there are some who are intimidating, or make you feel like it is their duty to trip you up on something. This can be disconcerting for someone who feels capable, yet is nervous about the flight test.

I respect the role and the importance of flight test examiners, and I encourage them to put the candidates at ease before and during the flight.

Derek Brown
Moose Jaw, Sask.

Thank you for writing. The flight examiner's responsibility is to ensure pilot licence holders are fully capable and qualified to exercise the privilege of their licence. It is Transport Canada's policy within the Pilot Examiner Program that examiners should do their best not to intimidate the candidates. The Pilot Examiner Manual expresses the following policy:

"Pilot Examiners are professionals who can be counted on to be on time and to be well organized and business-like in their conduct of flight tests. They are polite and respectful toward flight test candidates." —Ed.

Invest a few minutes into your safe return home this summer...

...by reviewing the requirements for flight plans and flight itineraries in Section RAC 3.6 of the *Transport Canada Aeronautical Information Manual* (TC AIM).



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An Ounce of Prevention...Parallels Between QMS and SMS Components

by Cliff Marshall, Technical Program Manager, Technical Program Evaluation and Co-ordination, Standards, Civil Aviation, Transport Canada

One of the critical things to consider as you begin the safety management system (SMS) implementation journey is that an SMS, as with any other management system, should be systematic and practical in design, comprehensive enough to adequately encompass all organizational functions, yet simple enough to use. Hence the reason each management system you introduce must reflect the unique size, complexity and character of your organization.

Although there are many similarities between an SMS and a quality management system (QMS)—they are both critical to the functioning of the organization—their outcomes are distinctly different. Quality, and its associated management system, focuses on the characteristics—typically expressed in terms of value—of its products, programs, or services, whereas SMS—with its focus on safety—is the minimization and management of operational risk related to human and organizational factors.

QMS integrates a set of policies, processes, and procedures required for managing structure, responsibilities, procedures, processes, and management resources to implement the principles and action lines needed to achieve the quality objectives of an organization. An SMS shares this structure; however, the focus is on safety objectives rather than product quality issues.

A QMS enables an organization to identify, measure, control, and improve the various core business processes that will ultimately lead to improved business performance through enhanced quality. Again, SMS parallels this continuous improvement philosophy and only differs by focusing on improving safety, not product quality. In an SMS, the quality assurance program (QAP) elements can be applied to human and organizational issues that may have an impact on safety. In the same way that a QAP measures quality and monitors compliance with the *Canadian Aviation Regulations* (CARs), its related Standards and the procedures utilized by the organization, the SMS measures safety within the organization. Expanding on this further, we can see that:

- quality assurance data is utilized in planning and designing a process that can repeatedly produce a high-quality product or deliverable;

- quality assurance provides confidence that if the process and procedures are followed properly, there is a high likelihood that the final product or deliverable will meet specifications. In other words, it reduces and prevents defects or errors in the final product or deliverable;
- quality assurance activity helps to establish a sound and capable process.

The main components of a QMS are:

- senior management's active and positive commitment;
- good two-way communication throughout the organization, which encourages a culture of initiative and improvement;
- simple, efficient monitoring systems that enable all levels of management to identify bottlenecks and waste;
- staff development, including training that provides the correct level of competence for each job and provides staff with opportunities to advance within the organization.

It is clear that there are parallels between QMS and SMS components. SMS is a systematic approach to the management of safety risks. Effective SMS and QMS both require all of the same components; however, the focus is markedly different. The SMS identifies hazards and manages attendant risks. It ensures the competency of the staff and promotes clear two-way communication. Both systems are compatible and, in Canada's regulatory framework, provide the overarching components of the organization's management systems that ensure compliance and manage the inherent operational risks. The benefits are measurable and afford the organization the ability to:

- review business and safety goals, and assess how well the organization is meeting those goals;
- identify processes that are unnecessary, inefficient or unsafe, and then remove or improve them;
- review the organizational structure, clarifying managerial responsibilities;
- improve internal communication, and business and process interfaces;

- improve staff morale by identifying the importance of their output to the business, and by involving them in the review and improvement of their work.

Both of these systems serve valuable purposes and, when combined, give the organization the ability to identify

quality lapses as well as the capability to identify human and organizational issues. Together, these two systems enhance flight safety, ensure compliance, and offer an enhanced approach to managing the business. The old adage applies: *safety* is good business! Δ

COPA Corner: Checking NOTAMs

by Kevin Psutka, President and CEO, Canadian Owners and Pilots Association (COPA)

As I sat in front of my computer, studying the details in the 18-page Olympics NOTAM, I wondered how many pilots would miss the extensive restriction or prohibition on flying that would occur from January 29 to March 25, 2010. Then I recalled a commitment made to the editor of the *Aviation Safety Letter* (ASL) to write about the NOTAM system and the importance of checking NOTAMs. By the time this article appears in the ASL, hopefully all will have gone well with the Olympics and everyone will have understood and complied with the complicated security measures.

Canadian Aviation Regulation (CAR) 602.71 states that, "The pilot-in-command of an aircraft shall, before commencing a flight, be familiar with the available information that is appropriate to the intended flight." This is a fairly broad catch-all statement that is open to interpretation as to how much information is sufficient. I suppose that one way to interpret this is that for your VFR romp around the patch you do not have to check anything (although that would be foolish), but if something goes wrong, you could be charged with a violation for not being prepared—which includes checking all NOTAMs that may affect your flight.

Some pilots never check NOTAMs because they assume that for their simple local flight there will be no restrictions or safety issues. After all, they have flown there hundreds of times before. While in years gone by this may have worked in most cases, we are now living in a more complicated world, with pop-up and sometimes extensive restrictions due to security concerns and an increasing number of airspace amendments to make better use of the limited airspace around our growing population centres.

In the "good old days" there were only two ways to check NOTAMs: visiting a flight service station (FSS) to sift through the hard copy listings, or contacting an FSS by phone or on the radio to ask them to scan the NOTAMs for ones that may affect you. This was a labour-intensive process, fraught with plenty of opportunities to miss something. As technology progressed, so did the ways to get at the information and, to some extent, the ways to sort through all of the data for what really mattered for the flight. Now, through NAV CANADA's weather

Web site, it is possible to receive only those NOTAMs that are

for stations along and either side of your intended route. However, because of limitations in the NOTAM system, there is still a requirement to view several non-pertinent or relatively insignificant NOTAMs in order to find the really important ones.

COPA has been encouraging NAV CANADA to make more changes to its weather Web site to make the process of checking NOTAMs more practical. For example, the layout of the Web site sets one up for forgetting about the NOTAMs. Pilots typically check the weather first and then drill down for other information if it is suitable to fly. The NOTAMs tab in the on-line report is at the top of the page, making it necessary to go back up to the top of the page to get to this information—an opportunity to forget. Without going into a lot of technical detail, it is not a trivial matter to make some of the improvements, but we can expect a prioritized system that will help to make the critical information stand out.

With the use of acronyms, abbreviations and requirements to adhere to International Civil Aviation Organization (ICAO) convention, it sometimes feels like you need a Ph.D. to understand NOTAMs. To some extent, we are living with the limitations of teletype machines that prevented plain language and use of certain characters. Hopefully, we will move away from these limitations as time goes on.

As for flying in the U.S., if you think that our NOTAM system leaves a lot to be desired, Canada is far ahead of the U.S. in at least having all NOTAMs available in one place. In the U.S., again in part because of past protocols and ICAO conventions, you can miss important NOTAMs because they are considered as "local" and do not show up on some systems. It is important to talk to a flight service specialist to maximize the chances of having all of the NOTAMs that are applicable. The U.S. Federal Aviation Administration (FAA) has been saying for some time that they are fixing this problem with a redesign of the NOTAM system but, for now, be careful when going to the U.S.



For IFR flight, it is important to check NOTAMs frequently because critical items such as minimums for approaches can change without notice due to a variety of factors. But for VFR flight, the volume of NOTAMs that have little or no affect on safety, such as several concerning burned out lights on cell towers, can make

it very tedious to find the really important ones. It is, however, worth the time to make that extra effort to find issues that may affect your flight. COPA will continue to work with the authorities to simplify and enhance the system. Now, more than ever, it is important to make that effort. Δ

Right or Wrong, He's the Boss

A cautionary tale by Garth Wallace

"I've been watching you with the students," Hector said to me.

Hector was manager of a small-town flying school where I had recently started teaching. He was helping another instructor and me pull the three training airplanes out of the hangar.

"You're doing a good job," he continued, "but I have a few suggestions."

I was surprised. I had been busy flying with Hector's students for five days and rarely saw him. He came to work, helped get the airplanes ready, and then disappeared until the end of the day. He was chatty and friendly when around, but mostly he was out of sight and out of mind. This was the first time that he had said anything to indicate his role as manager.

Roger, the other instructor, stood behind him. He looked happy that I was the target of the "suggestions".

"I noticed you do ground briefings with each student," Hector said. "A little talk doesn't hurt, but students learn better by doing. Don't waste time on the jawing when you could be flying and giving the customers practical experience."

I guessed that he was referring to the fact that flying was better revenue than briefing. His comments went against the teaching techniques that I had learned.

"I understand, Hector," I said, "but students need a pre-flight briefing to make sure they are on track."

"That's okay, but don't cut into the flying so much."

"Okay," I replied. I made a mental note to ignore what he had said.

"And another thing," Hector continued, "I noticed you're doing a walk-around inspection with the students on every flight. That's another waste of flying time. It's okay to show them the pre-flight but not each time. We check the aircraft in the morning, so the students don't have to." Skipping the pre-flight inspection was new to me. "How are the students going to develop good habits," I offered, "if they don't practise things like the walk-around? I thought you said students learned better by doing?"

"I did, but that's in the air, not on the ground. Just show them how to do the walk-around a couple of times, and that's enough. If you let them do it every flight, they'll leave the gas caps off or something like that. Besides, they'll wear out things like the oil access door, and we'll

be replacing them all the time. Students learn best by example."

I could think of several arguments against what the man was saying, but I decided they wouldn't be worth it. "Whatever you say, Hector."

"Just to show you," he added, "I'll fly with your first student this morning. But first, I'll do a weather check." The clouds were low. There was no weather office or flight service station (FSS) at the airport. When the conditions looked marginal, we flew a circuit to see if it was good enough to fly.

Hector's comments irked me. I suppose it was his sudden managerial spirit that got under my skin. He appeared to do no work and was rarely around. It was also significant that my first student was Gloria Simcoe, a 19-year-old university student.

Hector climbed into the first Cessna 152. I went back into the office. Gloria was waiting inside.

"Hi Gloria. Hector will fly with you this morning. He's doing a weather check first. He shouldn't be long."

"OK."

We both watched the airplane. Hector skipped the warm-up and pre-takeoff check, and he didn't use the runway. He started the engine and took off on the ramp straight from the fuel pumps. The airplane roared past the office window and into the air.

I was as surprised as Gloria, but she spoke first. "Is he supposed to do that?"

"Ah, oh, sure," I said. The incident had spiked the evil side of my brain. "We depart from the ramp all the time. We just make sure it's into the wind and there's no traffic. Have you never done it?"

"No, Hector never mentioned it."

"Well, today is a good time to try it. Hector will have run the airplane, so it will be warm and you'll know everything is working fine. If the weather is a go, skip your checks and blast off from the ramp."

"OK, sounds like fun," she said.

As if to stamp his approval on the idea, Hector landed on the ramp and parked the little Cessna near the office. He strutted through the door like a peacock. "Good morning, Gloria," he crooned in a musical voice. "The ceiling is high enough for circuits. We can practise those landings of yours. Ready to go?"

"Yes."

"Good. No sense wasting time on the ground," he added, looking my way.

"The airplane awaits."

I followed them out the door to help Roger fuel the rest of the fleet.

"Watch this," I said to Roger, motioning toward Hector and Gloria. They were already climbing into the Cessna.

"Watch what?"

"You'll see."

"All I see is Hector helping Gloria with her seat belt," he said.

"Watch them after she gets the airplane started."

"OK."

It was perfect. Hector relaxed and nodded toward us once the seat belts were on. Gloria started the Cessna, looked both ways and moved it forward a little to line up into the wind. Then she shoved the throttle to the firewall.

It took Hector about three seconds to realize what was happening. Another three seconds went by while he uncrossed his legs and got them on the rudder/brake pedals. By then, the aircraft was accelerating through 50 mph and Gloria was pulling back on the elevator control.

The airplane pitched forward as Hector slammed on the brakes. The main wheels locked, and the Cessna's tires painted two black lines down the ramp with the engine still at full power. Eventually, he got her hand off the throttle and the airplane wiggled to a stop.

There was a long period while they sat there. The airplane was rocking a little from Hector's gestures. He looked back at me. Even from that distance, I could tell he wasn't smiling.

"Did you set her up?" Roger asked.

"Yup," I replied.

I didn't know Roger or Hector very well. I wasn't sure how they would react to my little stunt, but it was too late now.

"I gave her a 'monkey see, monkey do' pep talk in the office while Hector was flying his weather check."

"You're a bugger," he said with a laugh.

"Thank you," I replied.

"Just be careful with Hector. He has a sense of humour, but occasionally he remembers to be the manager. You can push him too far."

"Okay, thanks for the advice."

Hector and Gloria turned the airplane around and taxied slowly to the runway for another takeoff.

I didn't have a student, so I was in the office when they returned from the lesson.

Hector tried to sound authoritative. "We'll book your next lesson," he said to Gloria. "We'll do more circuits, taking off from the runway."



Hector started the engine and took off on the ramp straight from the fuel pumps.

"OK, Hector," Gloria replied. I think she was fighting back a smirk.

He motioned for me to join him in the back office. He closed the door.

"Gloria said you told her to take off from the ramp. What do you think you were doing?"

"She saw you do it, so I told her it was OK," I replied.

"Well, you know it's not!" he fumed. "I'm a professional pilot with lots of experience. She's not. She might try that solo, and people could get killed."

He might have been right about Gloria trying it on her own, but he was exaggerating the kill rate. The ramp was plenty long enough, and the airport was never busy.

"I put her up to it to illustrate that students might try anything they see us do. If you hot-dog around a flying school, it's going to happen." My argument didn't come out as strong as it was in my mind.

"If we tell them not to, they won't," Hector said. His reply also sounded a little weak.

"Did you tell Gloria not to do touch-and-goes on the highway?" I asked.

"No, she knows better than to do that."

"Did you tell her not to chase boats on the lake?"

"No, she wouldn't do that, either."

"How about aerobatics?"

"No, of course not."

These were all things that Hector had bragged to Roger and me about doing.

"Gloria has no reason to think those are good ideas unless you tell her, like with taking off from the taxiway."

"I disagree. I think students are influenced by what they see. If they see you flying upside down in the school airplanes, I bet they can hardly wait to try it."

The exchange wasn't going very well. We were both getting frustrated.

"Look," Hector said with a sigh, "maybe we do things a little differently than where you're from, but we haven't

had any problems. It's my job to make sure the school is running well. This morning, I made a couple of small suggestions. If you don't like what we do, you should be talking to me, not the customers."

He was right about using the customers to make a point. I had gone too far. It was time to salvage my job.

"Hector, you're right. I shouldn't have told Gloria to depart from the ramp. I'm sorry. But I think we should set a good example in front of the students."

"Fine," he said, "we'll do that. But you're going to find that lots of pilots land and take off from the ramp here. This is not a big city airport."

"OK, thanks for the warning. I'll look both ways before crossing the ramp."

"Good idea," he said. The suggestion made him smile a little. "And don't forget to check the sky before venturing onto the highway," he added.

"OK," I said, smiling back. "What about boating?"

That made him grin more. "Yeah, and don't forget boating. If I ever catch you on the lake, I'll buzz you for sure."

Garth Wallace is a former flying instructor who lives near Ottawa, Ont. He has written 11 aviation books published by Happy Landings (www.happylandings.com). The latest is The Smile High Club. He can be contacted via e-mail at: garth@happylandings.com. Δ

Canada Labour Code, Part II, Section 127.1: The Internal Complaint Resolution Process

by Martin Gravel, Aviation Occupational Health and Safety Officer, Aviation Occupational Health and Safety Program, Standards, Civil Aviation, Transport Canada

Introduction

The purpose of Part II of the *Canada Labour Code* (CLC)¹ is "to prevent accidents and injury to health arising out of, linked with or occurring in the course of employment" at any workplace under federal jurisdiction. Employers and employees under federal jurisdiction² must comply with it. Part II of the CLC describes rights and obligations related to occupational health and safety. Among the many rights, obligations, procedures, definitions, and processes set out in this Part of the CLC is the internal complaint resolution process (ICRP), which is used to resolve complaints related to occupational health and safety.

The purpose of this article is to inform the Canadian aviation community about the ICRP and encourage employers and employees to use it to resolve workplace-related complaints themselves without involving an occupational health and safety officer. The process applies when an employee thinks the employer may be violating provisions of CLC, Part II, or its related Regulations, or both, and makes a complaint. The ICRP thus pertains to both air operators and their employees.

The process may seem complex at first, but in fact it is not. The following summary of section 127.1 of the CLC explains how it works.

ICRP Steps

First and foremost, it is important to understand the ICRP steps to avoid unnecessarily involving an aviation occupational health and safety officer. If an employee and employer affected by a complaint request the involvement of such an officer too soon, the officer may require that the parties first follow the ICRP before he or she conducts an investigation. In other words, the parties must show that they have tried to resolve the matter internally before they refer it to an aviation occupational health and safety officer. The process calls for cooperation between employer and employee (or the latter's representative). There are eight steps in the ICRP:

- Step 1:** The employee makes a complaint to his/her supervisor, orally or in writing.
- Step 2:** The employee and the supervisor attempt to resolve the complaint between them as soon as possible.
- Step 3:** The employee or the supervisor may refer an unresolved complaint to a chairperson of the local workplace health and safety committee. The complaint is then investigated by two members of the committee, one representing employees and the other the employer.
- Step 4:** The persons who investigate the complaint inform the employee and the employer in writing of the results of the investigation. They may recommend that the employer take corrective action relating to the situation that led to the complaint. If the persons who investigate the complaint conclude that the complaint is justified, the employer must inform them in

¹ *Canada Labour Code*, R.S., 1985, ch. L-2, sections 127.1, 128, 129, 132, 145. Internet: www.laws.justice.gc.ca/en/L-2/page-2.html#anchorbo-ga:l_l.

² The following definition appears in the CLC: "federal work, undertaking or business" means any work, undertaking or business that is within the legislative authority of Parliament, including: ... (e) aerodromes, aircraft or a line of air transportation; *Ibid*, section 2. Internet: www.laws.justice.gc.ca/eng/L-2/page-1.html.

writing and without delay of how and when the employer will resolve the matter.

Step 5: If the persons who investigate the complaint conclude that a danger exists, the employer must immediately ensure that no employees use or operate the machine or thing in question, work in the place or perform the activity in question until the situation is rectified.

Step 6: The employer or employee may refer a complaint to a health and safety officer in the following circumstances:

- (a) where the employer does not agree with the results of the investigation;
- (b) where the employer has failed to take action to resolve the matter or to inform the persons who investigated the complaint;
- (c) where the persons who investigated the complaint cannot agree between themselves as to whether the complaint is justified.

Step 7: The health and safety officer investigates the complaint.

Step 8: On completion of the investigation, the health and safety officer:

- (a) may issue directions to an employer or employee under subsection 145(1);
- (b) may recommend that the employee and employer resolve the matter between themselves; or
- (c) will issue directions if the officer concludes that a danger exists. If there is danger, the officer has the authority to direct that the necessary steps be taken or that something stop being done immediately, in accordance with subsection 145(2) of the CLC.

Conclusion

Parliament takes the view that the parties (the employer and the employees) are the ones who know the workplace best and are in a position to resolve any problems that may arise. In the field of aviation, it is the flight attendants, the pilots and the employers who know the

most about occupational health and safety on board aircraft. The purpose of the CLC, and more particularly the ICRP, is to encourage employers and employees to work together to resolve problem situations that may arise from time to time. There is no doubt that complaint resolution will be much simplified if the ICRP steps outlined above are followed.

"The legislative framework establishes a process that allows for a graduated series of investigations to resolve workplace issues while maintaining employment safety. The process allows for the resolution of workplace health and safety issues in a more timely and efficient manner and reinforces the concept of the internal responsibility system."³ It also reinforces the spirit of cooperation that needs to exist between employers and their employees, this being one of the main purposes of Part II of the CLC. As a matter of fact, when the CLC was last amended in 2000, Parliament sought to bring about a greater spirit of cooperation between employers and employees, and the ICRP is a perfect example of Parliament's intention.

"The process provides the employer/supervisor with the opportunity to address and correct employee concerns without the need to involve the workplace health and safety committee, the health and safety representative or a health and safety officer."⁴

Occupational health and safety is first and foremost a workplace issue. When it comes to a specific workplace, the experts are the people who work there.

For further information on occupational health and safety, visit Transport Canada's Aviation Occupational Health and Safety Web site at www.tc.gc.ca/eng/civilaviation/standards/commerce-ohs-menu-2059.htm, and Human Resources and Skills Development Canada's Labour Program Web site at www.hrsdc.gc.ca/eng/labour/health_safety/index.shtml. 

³ Human Resources and Skills Development Canada, Labour Program, Pamphlet 3—*Internal Complaint Resolution Process*, p.1. Internet: www.hrsdc.gc.ca/eng/labour/publications/health_safety/resolution.shtml.

⁴ *Ibid.*

Worth Watching—Again! The 26 *Weather To Fly* Video Vignettes

The 26 *Weather To Fly* vignettes, exploring the effects that weather (seasonal and otherwise) has on flying in Canada, have been available on the Transport Canada Web site in streaming video format for many years now. These excellent vignettes are a must-watch for any pilot.

View them today at www.tc.gc.ca/civilaviation/systemsafety/wtf/menu.htm. It's time well spent!



FLIGHT OPERATIONS

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Now What Am I Going To Do?

by Bill Payn, Civil Aviation Safety Inspector, ANS Standards, Aerodromes and Air Navigation Services, Standards, Civil Aviation, Transport Canada

"Lima Victor Mike, Centre, I have lost your radar target. Reset your transponder, code 2421, please." You check and the code is correct, so you switch the transponder to "STBY" and then return it to "ALT". "Centre, Lima Victor Mike, I reset the transponder. Do you have a target now?"

Several seconds pass.

"Lima Victor Mike, Centre, negative target. Do you have another transponder?"

Now you sit up a little straighter. "Darn, this thing was just fixed," you think to yourself.

"Negative, Centre. We have only one transponder," you reply.

Now the controller is sitting up a little straighter. It has gotten a wee bit more complicated than just watching you on radar and separating you from other radar-controlled traffic. The controller will terminate radar service, revert to applying non-radar separation for your flight, and plan for your arrival at Thunder Bay, Ont.

You are a private aircraft on an IFR clearance. You departed Toronto, Ont., on a flight to Calgary, Alta., with fuel stops planned for Thunder Bay and Saskatoon, Sask., and you are presently passing Sault Ste. Marie, Ont. The descent and approach into Thunder Bay is normal, but ATC asks for what seems like a hundred altitude reports, a multitude of distance measuring equipment (DME) reports with beacon outbound, a procedure turn, and inbound reports too.

But you're on the ground now and wondering how you are going to get to Calgary without a functioning transponder.

Well, let's look at *Canadian Aviation Regulation (CAR) 605.35*, which covers transponders and automatic pressure-altitude reporting equipment. We'll leave the pressure-altitude part of it alone, even though the same regulations apply. Remember also that transponder airspace is specified in the *Designated Airspace Handbook (DAH)* and includes all Class A, B, and C airspace. It also includes any Class D or E airspace specified as transponder airspace.



Transponders are pretty valuable pieces of equipment and assist ATC in providing a safe, orderly, and expeditious flow of air traffic. Pictured above is a basic transponder set at the VFR code of 1200, and mounted directly under a typical VHF communication radio. (Photo: Adam Hunt)

If you are operating an aircraft in transponder airspace, the aircraft must be equipped with a transponder. Easy so far. But you may operate that aircraft without a serviceable transponder (subsection 2 of the regulation) as long as you have a minimum equipment list (MEL) approved by the Minister and you operate in accordance with it. When you don't have an MEL approved by the Minister, as in this scenario, you can operate the aircraft to the next aerodrome of intended landing (Thunder Bay, in our case) and then complete a planned flight schedule or proceed to a maintenance facility. If Thunder Bay has the facilities to fix the transponder, there is no problem. If the next maintenance facility is located at Saskatoon, again, a problem does not exist. If no facilities exist in Saskatoon, the regulation allows you to continue on to Calgary. That is what completing a planned flight schedule means. It is not meant to allow you to fly your aircraft for an extended time period without a serviceable transponder but only to get you safely to a maintenance base at the first opportunity so that the transponder equipment can be repaired. You could even decide to file a new flight plan and proceed to Winnipeg, Man., to get to a maintenance facility. All this has to be done, of course, with an ATC clearance.

CAR 605.35(3) provides an ATC unit with the option of authorizing a person to operate an aircraft not equipped with a serviceable transponder, provided that they receive

a request from that person to operate in the airspace before the aircraft enters it and that aviation safety will not likely be affected. The ATC unit's ability under this subsection is limited in that it is intended only to support the requirements of subsections 1 and 2. This means that an ATC unit is not able to approve aircraft to operate without a serviceable transponder for any other reason, when the serviceable transponder is required under 605.35.

Now let's look at VFR operations. CAR 605.35 also applies to VFR aircraft approaching a Class C control zone without a serviceable transponder. The tower may authorize the VFR aircraft to enter the control zone if it is the next aerodrome of intended landing and may also authorize a departure to complete a flight schedule or proceed to a maintenance facility. As in the IFR example, the regulation is not intended to permit this VFR aircraft to continue operating in transponder airspace for an extended period of time. An ATC unit

may provide an authorization in the same manner as for an IFR aircraft. The regulation is not intended to permit an ATC unit to authorize a VFR aircraft to enter or leave the transponder-airspace control zone to circumvent the requirement to have a serviceable transponder. An example of this could include a Cessna 152 from the local flying club that doesn't have a serviceable transponder but wants to fly circuits for several hours that day. It might also include a helicopter that has never carried a transponder but is temporarily assigned to operate from the airport in a Class C control zone for a week or so and that wishes to do so without installing a transponder.

Transponders are pretty valuable pieces of equipment and assist ATC in providing a safe, orderly, and expeditious flow of air traffic. Hopefully, yours is and will remain working because an ATC unit cannot authorize your flight to operate without a serviceable transponder in airspace where it is required unless it supports an operation conducted under CAR 605.35. Δ

Advanced Qualification Program (AQP)—An Alternate Way of Training and Checking

by François Collins, Civil Aviation Safety Inspector, Airlines, National Operations, Transport Canada

For years, Canadian air operators have been training and checking their pilots under the traditional regulatory requirements of the *Canadian Aviation Regulations* (CARs). However, unknown to many, there is an alternative, voluntary training program available to these air operators called the Advanced Qualification Program (AQP). Under this program, Transport Canada (TC) is authorized to approve significant departures from traditional requirements, subject to justification of an equivalent or better level of safety.

The program entails a systematic front-end analysis of training requirements from which explicit proficiency objectives for all facets of pilot training are derived. It seeks to integrate the training and evaluation of cognitive skills at each stage of a curriculum. For pass/fail purposes, pilots must demonstrate proficiency in scenarios that test both technical and crew resource management (CRM) skills together. An air operator that participates in an AQP must design and implement data collection strategies which are diagnostic of cognitive and technical skills. In addition, they must implement procedures for refining curricula content based on quality control data.

The overall goals of the AQP are to increase aviation safety through improved training and evaluation and to be responsive to changes in aircraft technology, operations, and training methodologies. In general, an AQP differs from traditional regulatory requirements in terms of the following characteristics. First, participation is voluntary. Second, an AQP may employ innovative

training and qualification concepts, provided the air operator can demonstrate to TC's satisfaction that the resulting pilot proficiency will meet or exceed that obtainable through a traditional program. Last, but not least, an AQP entails proficiency-based qualification. That is, if pilots are trained to a standard of proficiency on all objectives within an approved AQP curriculum, it is not necessary to verify proficiency by virtue of a formal pilot proficiency check (PPC) on those items. Rather, the proficiency evaluation may consist of a sample of such items in order to validate that the training-to-proficiency strategy has in fact achieved its objectives. Terminal proficiency objectives (TPO), together with associated performance standards, replace TC's traditional event-driven compliance requirements. Each air operator, rather than TC, develops its own TPOs on the basis of an instructional systems development (ISD) process outlined in TC's Policy Letter 169—*Development and Implementation of an AQP*. Once approved by TC, these TPOs become regulatory requirements for the individual air operator. An AQP provides an approved means for the air operator to propose TPO additions, deletions, or changes as needed to maintain a high degree of crew proficiency tailored to the operator's line requirements.

In order to ensure that the increased flexibility inherent in AQP does not come at the cost of reduced safety, certain mandatory criteria have been established. Thus, an AQP must be aircraft-specific, provide qualification and continuing qualification curriculums for every duty position, as well as training and evaluation that is conducted to the maximum extent possible in a full

cockpit crew environment. It must also integrate training and evaluation of CRM where the evaluation of CRM proficiency is mandatory, and substandard performance on CRM factors must be corrected by additional training. In AQP, demonstration of proficiency in manoeuvre-oriented technical skills is a necessary but insufficient condition for pilot qualification. For pass/fail purposes, pilots must also demonstrate proficiency in a line operational evaluation (LOE), which tests both technical and CRM skills together.

The program must provide AQP-specific training for instructors and evaluators, and integrate the use of advanced flight training equipment, including full flight simulators. AQP encourages air operators to utilize a suite of equipment matched on the basis of analysis to the training requirements at any given stage of a curriculum. Judicious analysis of these requirements can enable an

AQP operator to significantly reduce the need for use of a full flight simulator, but only when the operator reaches Phase V, its final level of implementation. Finally the program must collect performance proficiency data on candidates, instructors, and evaluators and conduct internal analyses of such information for the purpose of curriculum refinement and validation. Air operators are also required to forward certain data to TC for independent analysis and measurement of the program.

In Canada, there is currently only one air operator that has chosen to take advantage of an AQP, but there are dozens more in other countries—especially in the U.S.—that have implemented their own AQP or are busy applying to join the program. Seeing that a well-managed AQP can provide air operators with advantages they could not otherwise benefit from, is the AQP the future of pilot training and checking? Δ

Tailwinds on Approach

by the Safety Management Planning and Analysis Division, NAV CANADA

Background

A question was recently forwarded to NAV CANADA through an operator's safety management system (SMS) regarding the timely provision of wind information during the approach phase of flight. The pilot related several experiences of being surprised by a tailwind, noting that the provision of information with respect to winds aloft appeared to be haphazard.

The pilot inquired about the information that air traffic services (ATS) could provide to notify flight crews of such tailwinds prior to commencing an approach, as tailwinds are a significant contributor to unstable approaches and preparation is the key to managing the situation. The earlier a flight crew is aware of such tailwinds, the more likely the crew will be able to mitigate their impact by configuring the aircraft for landing early.

The aim of this article, therefore, is to provide some details about the information available to ATS and to outline how pilots can help.

What information can ATS provide with respect to winds on approach?

Pilots have the most timely and accurate information with respect to winds on approach. ATS does not have access to real-time information about winds aloft and the wind information that is available to ATS is of limited use in predicting the winds on approach.

- Surface weather observations (such as aviation routine weather reports [METAR] and aviation selected special weather reports [SPECI]), aerodrome forecasts (TAF), and graphic area forecasts (GFA) all

provide either a report or forecast of surface wind conditions which may be, but usually are not, representative of wind direction or speeds aloft in the approach phase of flight.

- Given that wind instruments (anemometers) are normally positioned atop a 10-m tower, the wind measurements derived from them are not usually representative of the conditions aloft. A number of factors, such as local topography and atmospheric conditions (e.g. temperature inversion), may contribute to a significant difference between surface winds and the winds a pilot may encounter during approach.
- Alphanumeric upper level wind and temperature forecasts (FD) may not be representative of approach wind conditions either. These forecasts are produced by a supercomputer model of the atmosphere (without human intervention) and this model purposely does not consider weather data from near the surface of the earth (the boundary layer) for fear of its perturbations skewing the forecast of the vertical atmospheric profile. That is why the FD does not provide a temperature forecast for the 3 000-ft level.

Unfortunately, at this time there is no operational means of accurately measuring and reporting low-level winds. The use of wind profiler technology (vertically oriented sonar) is a possibility, but in Canada this type of equipment is currently only employed in a research and development capacity and, in any case, the means to disseminate minute-by-minute wind velocity



information does not currently exist in the Canadian Air Navigation System.

In the longer term, it may be possible to broadcast near-real-time wind velocity data obtained from aircraft, for example as part of a wake vortex monitoring and prediction system, but such a capability does not currently exist.

Therefore, at this time, pilots with on-board wind readouts have the most accurate, up-to-date information available with respect to winds on approach.

Pilot weather reports (PIREP) are an essential source of information with respect to wind velocities in the approach phase of flight. In fact, most of the time, the reporting and forecasting of low-level wind shear—which occurs from the surface to 1 500 ft—is predicated on it being first reported by a pilot.

Sharing information—Everyone has a responsibility for continuing the loop

As stated above, the best available source of information about winds in the approach phase of flight is on board the aircraft, and PIREPs are an important part of keeping everybody in the loop.

From an ATS point of view, flight information service (which includes sharing PIREPs) will be provided to all aircraft subject to limitations of controller workload and

frequency congestion (see *Air Traffic Control Manual of Operations* [ATC MANOPS] 161.1). At the same time, severe weather information must be provided to all aircraft entering the affected area (ATC MANOPS 162). This includes urgent PIREPs dealing with low-level wind shear, but would not extend to a PIREP relating to a tailwind on approach.

Pertinent significant meteorological information (SIGMET), air reports (AIREP) and PIREPs will be included in an automatic terminal information service (ATIS) broadcast (ATC MANOPS 172.3), although some discretion is required with respect to what is “pertinent”. Evidently, reports of severe weather would be included, while reports of tailwinds may be included since, as pilots will appreciate, ATIS messages are already too long at many airports.

Similarly, *Transport Canada Aeronautical Information Manual* (TC AIM) section MET 2.3 outlines the procedures for providing PIREPs, and provides a specific format for reporting wind shear (i.e. report wind above and below shear or impact on performance). There is no specific information relating to reporting tailwinds on approach, so pilots need to use discretion.

Conclusion

If you believe winds aloft are sufficiently different from those advertised at the surface so as to impact flight safety and should be passed on to other aircraft, provide a PIREP! Δ

Runway Selection

NAV CANADA frequently receives questions about how runways are selected. The following should shed some light on the subject.

ATC is required to assign the operationally suitable runway most aligned into the wind. However, there are circumstances where this may not be the case:

- If the surface wind speed is less than 5 kt, ATC may assign the “calm wind runway” which offers operational advantages such as greater length, shorter taxi times, avoidance of noise-sensitive areas, or better approaches.
- Additionally, at airports where preferential runways have been established, ATC may assign runways which are not most aligned into the wind according to the preferential runway agreements in place, provided the criteria for the use of these runways is met.¹ Specifically, the use of preferential runways is limited by a maximum crosswind component, which varies according to runway surface condition.

The use of calm wind runways or preferential runways offers customers significant operational advantages and improves airport capacity. However, it remains the pilot’s responsibility to ensure the assigned runway is operationally suitable.

Both pilots and controllers should be aware that the selection of runways that are not most aligned into wind can exacerbate the impact of changing winds aloft on aircraft performance, and should plan accordingly.

¹ TC AIM section RAC 4.1.3 provides more information on preferential runway assignments and the criteria for selecting active runways (www.tc.gc.ca/civilaviation/publications/tp14371/rac/4-0.htm#4-1-3).



Creating a Picture of Risk

by Cameron Fraser, International Association of Facilitators (IAF) Certified Professional Facilitator, RANA International

We live and work in a complex world and make decisions about risk every day. Experience is an important tool in identifying and assessing risk, but it also has distinct limitations and tends to narrow our focus to what has happened to us in the past. When making decisions about risk, there is a need for a methodical approach to risk identification and assessment in order to ensure we use, but are not limited by, our experience.

There are three keys to risk management or risk-based decision making:

- The importance of understanding the hazards and risks faced by your organization.
- The need to be able to scale your approach to your particular operation and situation (e.g. large vs. small operator, introducing a new type to a fleet vs. adding an additional aircraft of the same type, etc.).
- The significance and difficulty in reducing the consequences (on lives, property, reputation, etc.) of something going wrong in aviation. Thus there is a greater return on focusing risk management efforts on reducing probability rather than consequences.

Humans find it relatively easy to identify consequences and severity; however, we have a much less intuitive grasp on cause and effect and the probability of things occurring.

At its core, risk management is about asking and answering five questions:

- What could go wrong?
- How could it happen?
- How does it affect us?
- How can we reduce the likelihood of it happening or its impact if it does?
- What do we need to do next?

What is needed is a methodology to help identify risks, the ways they might occur, and possible outcomes. Only then can those two cornerstones of risk assessment—probability and severity—be evaluated. The bow-tie model is one such methodology. It is both powerful and easily understood. It is scalable and addresses the first three of the five questions asked above.ⁱ

Critical language

Prior to outlining the model, it is important to define some critical terms.ⁱⁱ

Hazard: Any real or potential *condition* that can cause degradation, injury, illness, death or damage to, or loss of, equipment or property.

In describing a hazard, there is a tendency to name it as an outcome, for example, “electrocution,” versus the real hazard, which may be “an exposed, energized, unprotected extension cord.” That tendency narrows the focus, thus reducing the chance that a full range of risks will be considered.

A well-defined hazard statement is one from which the risks, how they might occur and how they might affect us can easily be implied, but are not explicit. For example:

“Operation of a single-engine aircraft into an isolated and distant airport with limited alternates, navigation aids and maintenance facilities.”

This hazard statement describes a common operation in Canada but, while it does not explicitly state anything that could go wrong, the reader can undoubtedly create a healthy list of possibilities.

Risk: The possible injury, illness, death, damage or loss. (An event. Given the hazard, what could go wrong?)ⁱⁱⁱ

Risk scenario: A postulated sequence of events including, as the final event in the chain, the risk. (How could it happen?)

Consequence: The possible outcome(s) should the risk occur. (How does it affect us?)

Risk level: A measurement of risk resulting from a consideration of (at least^{iv}) probability and severity.

The bow-tie model

Different decisions about risks require different levels of response, and scalability is a key feature of the bow-tie model. The approach chosen must consider the size and complexity of the operation, any time constraints on the decision-making process, and the impact of the decision.

At its simplest, the bow-tie model builds a timeline: the risk (event) preceded by a cause, and followed by a consequence. Thus risk is the knot of the bow tie and the cause(s) and consequence(s) are the “wings” (see Figure 1).

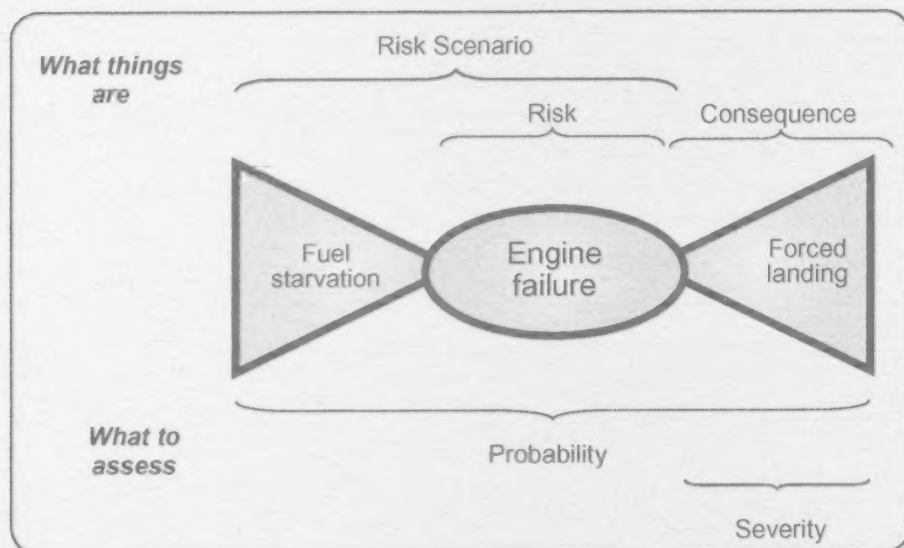


Figure 1

It is important to realize that the way we do this work and the way we record this work is a bit at odds. Although we read the bow tie left to right as a possible timeline, we identify the risk first, and then identify causal event(s) to the left and consequence(s) to the right.

Assessing risk

Risk cannot be examined without considering both probability and severity. The mechanics of assessing severity are relatively easy. Regardless of whether you are using a simple high, medium, low scale, or a five-point scale with descriptors for each level, severity only rates the impact of the consequence.

Probability, however, is rated across the whole sequence of events. In the simple example in Figure 1 it would mean asking, "what is the probability of suffering fuel starvation, leading to an engine failure and a forced landing?" There are two commonly made mistakes around the assessment of probability:

- Rating only a single element of the scenario: "What is the probability of suffering an engine failure?" Doing so may cause an unrealistic evaluation of the level of risk. Single negative events may occur frequently, but multiple layers of defence prevent them from snowballing.
- Assuming the cause has occurred and rating the probability of the consequence: "If we suffer fuel starvation what is the probability of an engine failure?" Doing so can cause an unrealistically high evaluation of the level of risk. In the example, if you have fuel starvation, an engine failure is no longer a risk—it's a certainty.

While not immediately intuitive, rating probability across the whole range of cause-risk-consequence is consistent

with what we know about aircraft accidents and incidents: they are not single-cause situations, and several layers of defence need to fail before things go very wrong.^{vi}

Finally, this clarity around probability and severity is critical for identifying mitigations. The level of risk is assessed by multiplying the rating of probability by the rating of severity. The resulting **risk level** is the trigger that tells you the relative ranking of risks. The individual probability and severity numbers tell you what kind of mitigation is most appropriate: prevention

of causes as defined by the risk scenario or recovery from consequences.

Scaling the bow-tie model: Adjusting for complexity

A risk with a single cause and single outcome is very rare, so the approach to identifying risks, causes, and consequences must be scalable. There are many tools available that can be used or adapted to help build risk bow ties. These may include the Kepner and Tregoe problem analysis process first articulated in the late 1960s,^{vii} the Ishikawa fish bone cause and effect diagram, or fault tree and event tree analyses.

What follows in Figure 2 is one level of sophistication up from the simple bow tie. This generates more scenarios for analysis: twelve related to fuel starvation (three possible starting points x four possible outcomes).

At this level of sophistication we may classify the types of cause. Commonly used categories are natural, economic, technical and human^{viii}. In the example in Figure 2, there are natural, technical, and human causes and each type would be mitigated differently. In addition, identifying a type of cause helps ensure that a range of possibilities has been covered. If you have natural, economic and technical causes, but have failed to consider human causes, you might wish to expand your scenario-building efforts.

One level of complexity higher uses the fault tree and event tree analysis for the scenarios and consequences, respectively. This provides an increased level of detail on the consequence-side of the bow tie, which means many more scenarios. This approach can generate hundreds—and perhaps thousands—of possible risk scenarios. While this may accurately represent the complexity of

aviation, it can become difficult to manage. What is needed is a scaled approach to fit the circumstances with a combination of the above methodologies to create the most useful approach in any given situation.

The most practical approach has generally been to use the fault tree analysis for generating scenarios while limiting the identification of consequences to a single level. This reduces the complexity and number of scenarios, while focusing efforts on elaborating the causes/probability side of the bow tie, which is where those in aviation can create the most effective mitigation.

Putting it into practice

When working with groups on risk assessments, identifying a large number of bow ties takes relatively

little time. The larger effort comes when assessing them for probability and severity. It is recommended that you:

- use post-it notes and a large wall;
- involve a group with a range of expertise and experience;
- assign someone from your organization to act as facilitator. This person does not contribute to the discussions, instead, he or she keeps the group organized and on task, and records the work;
- start by brainstorming risks. You may wish to sort the list into high, medium and low priorities to help decide which ones you use first for building bow ties;
- take each risk and work backwards to identify possible causes. Ask yourself "why?" five times. Why did the

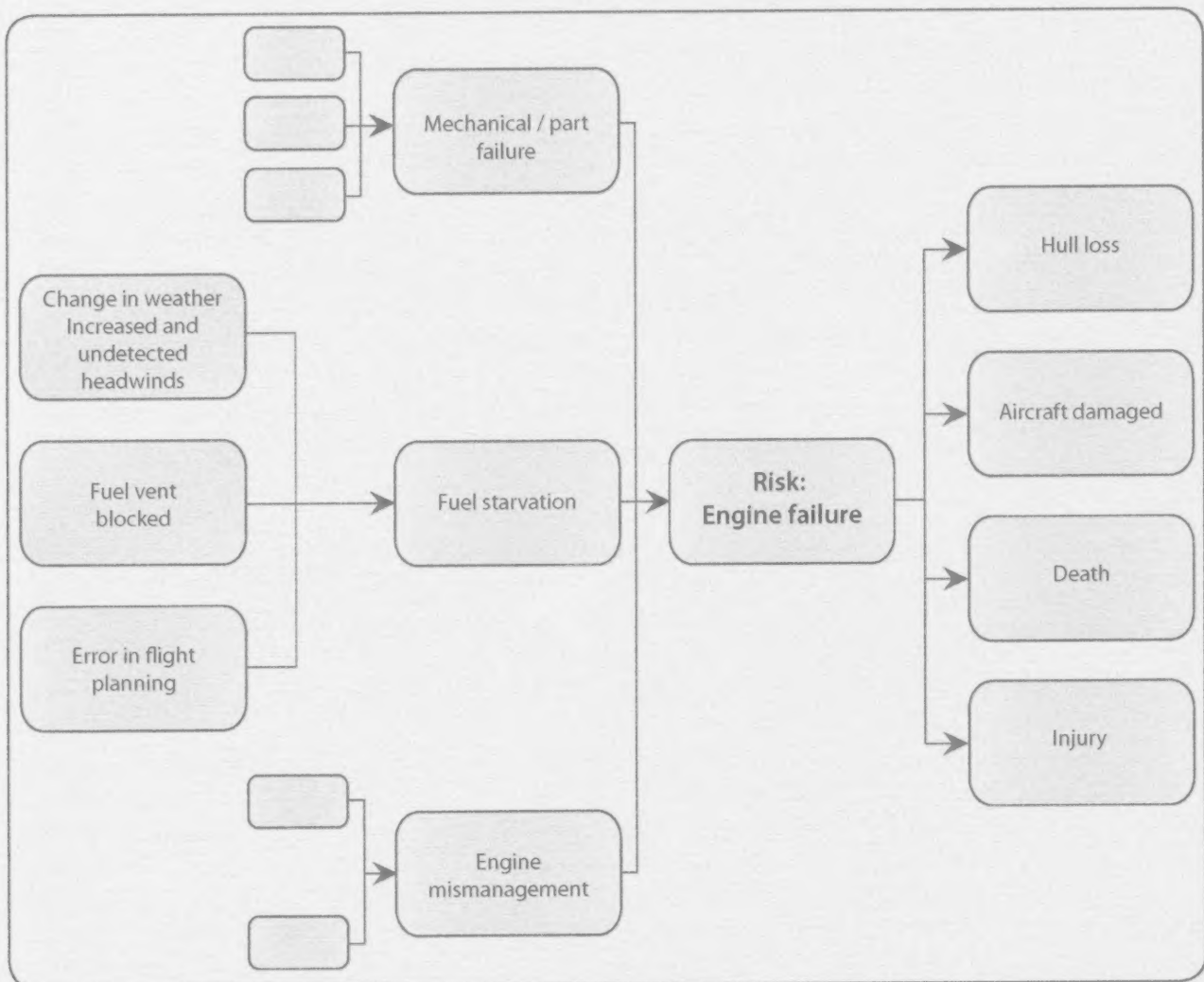


Figure 2

engine fail? Fuel starvation. Why did we have fuel starvation? Error in flight planning, etc.;

- identify consequences once you have scenarios built. Similar to the value gained by identifying human, natural, economic and technical causes for scenarios, it can be useful to identify categories of consequences. Some common types include:

- property,
- health,
- finance,
- liability,
- people,
- environment,
- stakeholder/customer/public confidence.

A last caveat: anyone working in risk-based decision making should accept that it is not possible to identify every risk and every risk scenario or consequence. With appropriate effort, you will develop a sampling that will generate a range of mitigations that, in turn, will

address the identified risks and probably some you hadn't thought of. In effect, if thinking about Reason's elegant swiss-cheese model, you are adding several more layers of defence and closing some holes in existing defences as well.

The identification of a hazard—and the associated risks, causes and consequences in the form of the bow-tie model—lies at the very heart of risk assessment. Do this well, and you are half-way home to completing a well-thought-out and well-documented risk assessment, and are further contributing to the overall safety of your operation.

Cameron Fraser is a certified professional facilitator who has over 25 years of experience in areas such as strategic thinking, business and project planning, process improvement, decision-making, collaborative problem-solving and the delivery of training in both the public and private sectors. He can be reached at cfraser@ranaprocess.com. Δ

ⁱ Note that the term bow-tie model has been used in various ways by a variety of individuals. Some use it as a pure description of a risk situation; others use it to show how mitigations fit into a chain of events or consequences. Both approaches are valid and this article deals with the former approach, consistent with Transport Canada Civil Aviation's risk management methodology, which separates the identification and mitigation of risk.

ⁱⁱ Some of these terms are defined differently than in other risk management processes. The author's intention is not necessarily to have these definitions adopted by others, but rather to provide users with definitions for the information required—and to have the terms used consistently. The author has seen risk management presentations use the words "hazard" and "risk" interchangeably. He has also seen examples where terms are defined one way but used in another. Effective processes require that those who follow them focus on one type of information at a time, and the language used in the process needs to support that. In this article "hazard", "risk", "risk scenario", "consequence" and "risk level" all refer to discrete pieces of information to be developed—through individual steps in a process—in order to understand and manage those things that could go wrong.

ⁱⁱⁱ The failure to maintain the distinction between hazard (the condition) and risk (the possible event), and risk and risk level (or

risk index—the measure of probability and severity) generally leads to confusion and frustration.

^{iv} The "at least" is because some organizations use additional measures, such as exposure, to refine their picture of risk. That's fine, but you cannot assess risk without both probability and severity information. Anything else is optional.

^v Making either of these errors will probably cause you to inflate the assessment of the risk level. The good news is that this will generally require a more conservative response, resulting in a greater margin of safety. On the other hand, it means you will be dedicating more effort than necessary to managing a particular risk. In the worst-case scenario, it will affect the credibility of the assessment ("That's way too high. We know it's not right so let's ignore the assessment.")

^{vi} Sydney Dekker has said, "Murphy's Law is wrong. What can go wrong usually goes right..." (see *The Field Guide to Human Error Investigations*). The difficulty occurs when a number of things go wrong in a short period of time.

^{vii} See *The New Rational Manager*® 1981, Kepner and Tregoe Inc.

^{viii} Some have suggested removing human as a type of cause. The logic, as suggested by Sydney Dekker, is that "human error is not an explanation...human error demands explanation". Others have suggested considering systemic causes as an additional category.



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MAINTENANCE AND CERTIFICATION

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Exhaust Systems: Inspection and Maintenance Tips

by Joe Escobar, Editor, Aircraft Maintenance Technology (AMT) on-line magazine (www.amtonline.com). This article originally appeared in the July 2005 issue of AMT Magazine and is reprinted with permission.

An aircraft's exhaust system is critical to flight safety. Defective exhaust systems can lead to carbon monoxide poisoning, fire, or loss of engine performance. There are some tips that can ensure you are properly inspecting and maintaining these systems. I talked to Tom Heid, President of Aerospace Welding Minneapolis Inc. (AWI) to learn some of these tips. Heid is an A&P who is very familiar with exhaust system inspection and repair. Here are some pointers he shared during our conversation.

General inspection tips

Before inspecting the exhaust system, be sure to remove all shrouds and shields from the muffler and stacks to permit full inspection. Some mechanics get in a hurry and instead of removing the shroud, they will open it up, split it open manually, and just kind of look around in there, and then close it back up. Heid has several examples of cracks and deformities in mufflers that wouldn't have been caught if the shroud were only partially removed.

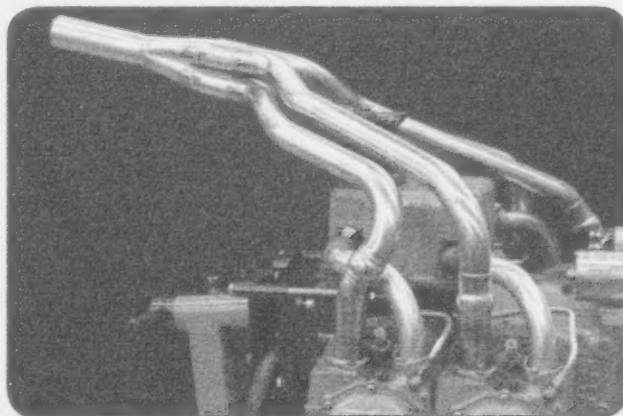
During inspection, you want to look for signs of leaks. Inspect the surface areas of components next to the exhaust system for signs of exhaust soot. Also look for signs of leaks on the exhaust system itself. Leaks will appear as a yellowish or orangish powdery residue. Any time you have that kind of discoloration in an area of an exhaust part is a good telltale sign that you have a leak. You want to pay particular attention around welds, clamps, and flanges.

Another way to find leaks is by performing a pressure test. Refer to your maintenance manual for detailed procedures of a pressure test. In general, to do a pressure test, you insert an air source such as a shop vac (in reverse mode) or regulated shop air in the tail pipe and pressurize the exhaust system to about 3 to 5 psi. Be careful not to overpressurize the system as exhaust system and/or engine damage can occur. You can then spray a soap and water solution on all the joints and the system in general to make sure there are no cracks, pinholes, or any excessive leaks at the clamp or slip joints.

You also want to inspect all surfaces for metal fatigue. This will be indicated by bulges, distortions, or cracks. Examine bends in pipes for pitting and thinning of material. You can use an awl to probe material in suspected weak spots.

Use a flashlight to shine into pipes for inspection. You can also use a borescope to examine internal components.

Inspect for damaged or missing heat studs, fins, or other heat-sink material. These defects can cause uneven heating of the muffler surface and lead to holes in the muffler can.



Proper exhaust system inspection is critical to safe operation.

Look to see if the muffler has internal baffles or tubes. If the baffles are damaged or missing, repair or replace the muffler. Broken baffles may become dislodged and restrict the outlet and cause power loss.

Inspect internal areas where possible for wear, pitting, cracks, and broken baffles. Corrosion may be occurring on a component that looks good externally.

Installation tips

AWI offers the following installation tips for exhaust systems.

- Don't force fit any parts: cracking will occur and shorten component service life.
- Do not reuse gaskets.
- Make sure that all parts are properly aligned. First, loosely mount on aircraft, then tighten all connectors to OEM specifications; retighten after a hot run.
- Use an anti-seize compound rated to at least 1,400 F such as Bostik Never-Seez® or Loctite C5-A on all slip joints.
- Inspect all hardware and clamps for wear, pitting, or heat stress. Replace as necessary.

Turbo 182

On a Turbo 182, unlike other exhaust systems that have a turbo system installed, there is no support bracket for the turbo. All of the weight of the turbo rests on the exhaust header (or Y assembly as some people refer to them). This puts a lot of stress on that header. There have been several of these exhaust headers that crack and break. This can cause an in-flight fire, and it is an area that needs to be inspected carefully. It is an extreme safety factor.

Repairs

Since many mechanics don't have the tungsten inert gas (TIG) welding equipment, expertise, or comfort level to do an exhaust system repair, sending it out for repair is a common practice. There are repair stations like AWI that specialize in exhaust system repairs. As an alternative, some mechanics choose to take the exhaust part to their local welding shop to have it repaired. If you are having a local shop do the repair or if you are tackling the repair yourself, there are several things you need to know to help ensure you get a good repair.

Alignment. Proper alignment is important when repairing an exhaust system component. Most repairs need to be done in a jig in order for the component to fit properly during re-installation. Not using a jig can cause improper alignment, setting up stress after installation that can damage the part.

Lack of experience. Many welders don't have experience working with aircraft exhaust systems. Exhaust systems are comprised mostly of 321 stainless or 601 or 625 inconel. There aren't many other things that are made out of these alloys, and most general welders don't have the experience of working with them. Even if the welder has welded stainless before, it is not the same as 321 stainless, which requires a specific rod and specific techniques. Using the wrong rods coupled with wrong procedures will result in a weak joint.

Proper cleaning. Thorough cleaning of the part is critical. The outside of an exhaust system component is typically dirty with oil and other deposits on it. But just cleaning the exterior of the part is inadequate. The inside of the part is full of carbon deposits left behind from burnt fuel and fuel additives. As soon as you start welding, the crack opens up from the heat, and that contamination from inside the part is pulled right through into the weld puddle creating a weak weld. So the part needs to be thoroughly cleaned inside and out before welding.

Purging. A final tip for welding is to ensure the part is purged when welding. Purging is the process of providing a separate source of argon to the inside of the part. This pushes all of the air out of the part and creates a

pure argon atmosphere inside the part. This pure argon atmosphere helps pull the weld puddle through the crack during the welding process, and the resulting weld is as clean on the inside as it is on the outside. Not purging will cause oxidation of the weld puddle on the inside, creating a rough, jagged bead. Not only is this a weaker weld joint, but the jagged edges will disrupt the gas flow creating hot spots that will set up spots for future failure.

Stainless vs. inconel

Another thing that mechanics need to be aware of is that exhaust system components can be manufactured out of either stainless or inconel. These two materials are similar in appearance and can be difficult to differentiate without chemical tests or destructive (grinding) analysis. It is important to realize that these two materials have different characteristics that affect the visual indications of a pending failure.

Over time, stainless steel tends to deteriorate. The molecules of the metal start to break down, and the metal starts to stretch, bulge, and deform. This is a good visual indication that the part is close to failure and requires repair or replacement.

Because of this susceptibility of stainless to weakening and bulging over time, some engineers decided to go with a stronger metal that could withstand the heat and prevent these bulging failures. They chose inconel, a metal in the stainless-steel family that has more nickel and chrome in it, allowing it to withstand higher heat. Typically, inconel does not bulge and deform like stainless does. But what it does do is pit out from the inside. The metal properties of inconel aren't very compatible with the mineral deposits that are left behind in AvGas. This causes severe pitting, almost like a cancer. Heid notes that 95 to 98 percent of the inconel parts that come through their door are severely pitted out.

The bottom line is that as a mechanic you may not know what material you are inspecting. Just because there are no cracks or bulges on the system, doesn't mean that there aren't any defects. You could be looking at an inconel part that is pitting from the inside.

Proper exhaust system inspection is critical to safe operation. By knowing proper inspection procedures and ensuring your parts are being properly repaired, you can do your part to ensure the aircraft doesn't experience an exhaust system failure.

Inspection tips

AWI has produced a free catalogue titled *Aircraft Exhaust & Engine Mounts*. It shows all the applicable part numbers for major components and extras like gaskets

and clamps. The catalogue also points out specific areas where special attention should be paid during inspection. To request your copy of the catalogue, you can call (800) 597-4315 or you can download it at

www.awi-ami.com.

Beware of backfires


Engine backfires are extremely hard on exhaust systems, especially muffled systems. Backfires stress the entire

exhaust system in a very abrupt, severe manner. They can damage baffles, possibly breaking them loose. Backfires can also bulge or crack the can. Any backfire warrants a thorough inspection of the entire exhaust system.

Additional resource

Aerospace Welding Minneapolis Inc.

(800) 597-4315

www.awi-ami.com 

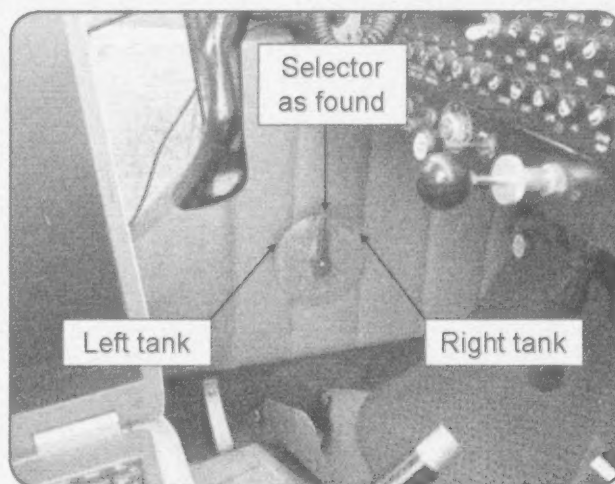
Fuel Starvation Due to Fuel Selector Condition

The following is an Aviation Safety Information Letter from the Transportation Safety Board of Canada (TSB)

On September 12, 2006, a privately operated Piper Cherokee PA-28-180 was in the circuit pattern for Runway 06R at the Montréal/St-Hubert, Que., airport. On base leg, at about 700 ft above ground level (AGL) and prior to landing, the pilot changed fuel tanks and selected the electric fuel pump to "ON" in accordance with the aircraft approach checklist. After a few seconds, the engine lost power. The pilot elected to turn off all electrical switches and execute a forced landing into a busy intersection. On final approach for the forced landing, the aircraft vertical stabilizer struck a telephone pole retaining wire, the right wing struck a vehicle, and the aircraft flipped over, striking three more vehicles before coming to rest. The vehicle occupants, pilot, and aircraft passenger sustained minor injuries. The TSB classified this accident as a Class 5 occurrence (A06Q0160).

When the aircraft was recovered, the fuel selector was found positioned midway between the right and left fuel-tank selection positions. Testing of the fuel system with the engine in the accident aircraft running revealed that, by positioning the fuel selector in the midway position, the fuel flow to the engine was reduced to a fuel starvation state, followed by engine stoppage. Examination of the fuel system revealed no anomalies, with the exception of the fuel selector. The fuel selector was very difficult to move, and the detent positions were barely perceptible. The condition of the fuel selector valve assembly was consistent with a component that was not maintained in accordance with the manufacturer's maintenance recommendations.

The fuel selector valve installed in the accident aircraft is a three-position type valve. An integral part of the valve is a tapered plug cock. This tapered plug cock, unless properly lubricated, is subject to binding or "freezing" caused by fuel coming in contact with the plug cock and gradually dissolving the film of lubricant, by the presence of foreign material, or by hardened or congealed lubricants, usually of the wrong type.



Fuel selector, as found

On June 5, 1972, Piper Aircraft Corporation issued Service Bulletin (SB) No. 355, titled *Fuel Selector Valve Lubrication*. SB No. 355 is applicable to Piper aircraft model PA-28-180 (serial numbers 28-1 to 28-7105179 inclusive), as well as to other small Piper aircraft. The primary objective of this SB is to ensure that the fuel selector valve is periodically and properly inspected and lubricated. The compliance time was within 10 hr of operation of the effective date indicated on the SB. The inspection/maintenance provisions of this SB were to be repeated at: each 100-hr interval, until the aircraft reached 400 hr of operation; then every additional 400 hr of operation or annually, whichever occurred first; or whenever the fuel selector valve was difficult to operate. This SB had not been completed on the occurrence aircraft, nor was the owner aware of its existence.

In Canada, owners of small, non-commercially operated aircraft may use the maintenance schedule provided by Transport Canada (TC) in *Canadian Aviation Regulation* (CAR) 625, Appendix B, Part 1 and Appendix C. Alternatively, owners could use the aircraft manufacturer's maintenance checklist, if available,

provided that this checklist includes at least all the applicable items listed in CAR 625. The tasks listed in the TC maintenance schedule are described only in general terms; whereas, the maintenance checklist produced by the manufacturer is detailed and includes references to the applicable service letters and SB produced by the manufacturer. The occurrence aircraft was maintained in accordance with the CAR 625 maintenance schedule.

The CARs clearly state that the maintenance of an aircraft is the responsibility of the owner. Therefore, should owners choose to use the less-detailed maintenance schedule in CAR 625 to maintain their aircraft, they are still responsible for developing an appropriate checklist for use with the maintenance schedule, and for being aware of any additional maintenance items such as out-of-phase items, service letters, SB or Airworthiness Directives (AD) that may apply to their aircraft. Δ

SAR Flash

by Major James Pierotti, Officer in Charge, Joint Rescue Co-ordination Centre (JRCC) Victoria

Recently, a Cessna 140 with two people on board was transiting northern British Columbia. The weather was beautiful and the aircraft was in great shape, so what could go wrong? In a particularly remote, heavily forested area, a flock of birds rose up, right in front of the aircraft. Despite manoeuvring, one bird struck the air intake and shut down the engine. The pilot did an excellent job of controlling the forced landing, and settled into the trees with only minor injuries to both occupants.

At this point, the full scope of their troubles became evident: they had not filed a flight plan; they did not have an emergency locator transmitter (ELT); and they had very limited survival gear. Fortunately, a concerned aviator at one of their last stops had noticed their lack of emergency beacon and had loaned them a portable distress beacon in the hopes that, if anything really bad happened, they would have some method of alerting the search and rescue (SAR) system.

After the crash, they made hourly calls on 121.5 MHz on their still functioning radio. Unfortunately, there was no one to hear their calls on 121.5 MHz. After some difficulty with an unfamiliar device, they were able to activate the distress feature on the portable beacon, and the emergency message was heard and relayed to JRCC Victoria. Had they been injured more extensively and unable to do so, these two aviators would likely have died out there because no one knew to look for them.

You are probably saying to yourself that this could never happen to you because you always file a flight plan and have a functioning 121.5 MHz ELT. Remember that the 121.5 MHz ELT requires high flyers to hear the signal, so it can take a long time in a remote area; in the case above, the hourly calls on 121.5 MHz did not produce any help.

Our plea to you is to always make sure you file a flight plan or itinerary, and to strongly recommend that you fly with a properly registered 406 MHz ELT, so when everything works against you, you have a tool that automatically sends the cry for help automatically for you. Δ

Transport Canada's Safety Management Systems (SMS) Information Session Montréal, Quebec, Fall 2010

www.tc.gc.ca/eng/civilaviation/standards/sms-info-menu-638.htm



RECENTLY RELEASED TSB REPORTS

The following summaries are extracted from Final Reports issued by the Transportation Safety Board of Canada (TSB). They have been de-identified and include the TSB's synopsis and selected findings. Some excerpts from the analysis section may be included, where needed, to better understand the findings. We encourage our readers to read the complete reports on the TSB Web site. For more information, contact the TSB or visit their Web site at www.tsb.gc.ca. —Ed.

TSB Final Report A06O0186—Collision with Terrain

On July 19, 2006, an American-registered float-equipped Cessna 180H took off from Cordingley Lake, Ont., at 09:05 Eastern Daylight Time (EDT) on a local flight with the pilot and two passengers on board. The owner of the aircraft, a licensed pilot, occupied the right rear seat, and a second passenger—also a licensed pilot—was in the right front seat. After completing the engine run-up checks, the take-off run was commenced without backtracking. After liftoff, the aircraft reached tree-top height but would not continue to climb or accelerate. As the aircraft crossed the shoreline and made initial contact with the tops of trees, full flaps were selected and the aircraft nose was raised so that the floats would absorb the impact. The floats struck the trees and the aircraft pitched nose-down and struck the ground in a near-vertical attitude. The three occupants received minor injuries. A small, post-impact, fuel-fed fire occurred forward of the firewall; the fire did not spread beyond that localized area.

Aviation Administration (FAA) did not recognize that the performance analysis provided by the applicant was not valid for the floatplane version or that there would be an associated performance reduction.

- As a result of the performance reduction, the aircraft could not achieve the published take-off and climb performance specifications; this contributed to its inability to clear the obstacles at the end of the lake.
- The pilot was not familiar with the take-off procedure developed by the owner of the aircraft to compensate for the performance degradation.
- During the takeoff, the owner occupied a rear seat where he could not adequately monitor the takeoff and provide appropriate advice to the pilot.
- The pilot did not use the full length of the lake for takeoff, reducing the time available to assess the aircraft's performance and limiting the options available when the expected performance was not achieved.

Findings as to risk

- Maintaining full power after the aircraft was committed to descending into the trees increased the risk of damage and post-impact fire.
- The type certificate data sheet for the Cessna 180 indicates that a wide variety of propellers may be installed on the aircraft, but does not define which propellers are approved only for the landplane and, therefore, are not suitable for the floatplane. As a result, maintenance organizations and aircraft owners may unknowingly install propellers that do not satisfy the airworthiness standards for the aircraft.
- The 1969 Cessna 180 floatplane, amphibian, and skiplane owner's manual supplement does not indicate either in the limitations section or the required equipment section that the airworthiness standards for the aircraft require that an 88-in. propeller be installed. As a result, pilots and operators will be unaware that shorter-diameter propellers are not approved for use on the floatplane version of the aircraft.
- STC SA1749WE, for the installation of Canadian aircraft products series 3000D floats, approves the floats for operation at higher gross weight than the floats they replace, but does not provide performance operating data at the higher gross weight.



Aircraft take-off path

Findings as to causes and contributing factors

- In approving the supplemental type certificate (STC) for the three-blade propeller, the U.S. Federal

Safety action taken

Hartzell Propeller Inc. is studying the effect on aircraft performance of the propellers listed on the Cessna 180 type certificate data sheets. If flight tests are required, it will present the results to the FAA. It will also keep the TSB advised of its test progress and discussions with the FAA.

TSB Final Report A06A0115—Loss of Cabin Pressure

On November 3, 2006, a Canadair CL600-2B19 was on a scheduled flight from Toronto, Ont., to Fredericton, N.B. While in cruise at FL330, the flight crew observed the cabin altitude climbing at a rate of approximately 1 000 ft/min. A descent clearance to FL250 was requested from the Moncton area control centre (ACC) and, after the aircraft was level at FL250, a continued increase in cabin altitude was observed. The crew requested and received clearance for further descent to 9 000 ft. The pilots donned their oxygen masks during the descent as the cabin altitude climbed through 10 000 ft. When the cabin altitude reached 14 000 ft, the passenger oxygen masks automatically deployed. The aircraft was levelled at 9 000 ft where it remained until descent for final approach was initiated. The aircraft landed at Fredericton without further incident at 2115 Co-ordinated Universal Time (UTC). There were no injuries to the 50 passengers or 3 crew members.

Finding as to causes and contributing factors

1. The combined effect of the detached left air conditioning unit pack system air supply duct, the detached right system pressure regulating shut-off valve line, and the missing return spring on the left system bulkhead check valve resulted in the loss of cabin pressurization.

TSB Final Report A06A0114—Collision with Obstacle During Takeoff

On November 6, 2006, a de Havilland DHC-6-300 Twin Otter had been converted from float to wheel landing gear and was being repositioned from the Marine Atlantic dock to the Goose Bay, N.L., airport. During the takeoff from the dock, the main wheels of the aircraft struck a wooden safety curb that surrounded the dock perimeter. After visually inspecting the landing gear in flight, the pilots continued the planned flight and landed at the Goose Bay airport. On landing, the right main gear collapsed and separated from the aircraft. The aircraft veered to the right and came to rest on a taxiway on the right side of the runway. There was damage to the right landing gear, the right wing tip, and the outboard



aileron hinge. There were no injuries to the two pilots on board. The accident occurred at 16:31 Atlantic Standard Time (AST), during daylight hours.

Analysis

There is a history of DHC-6 operators successfully conducting takeoffs from the marine dock after float-to-wheel conversions. Although this was the first attempt by this captain to take off from the dock, the first officer had completed a number of takeoffs from the dock with another operator. Both pilots were highly experienced on type, and both mentally calculated that there was sufficient distance on the planned take-off path to get airborne safely. However, the take-off distance available measurement was shorter than estimated, and the reduction in take-off performance due to the effect of the dock depression was unforeseen. The combination of these circumstances resulted in the landing gear striking the wooden safety curb.

The aircraft was being operated under *Canadian Aviation Regulation* (CAR) 704 and the associated requirements of the company operations manual (COM). However, not all of these requirements were met in that the discussion between the captain and the director of flight operations (DFO) or chief pilot did not take place. This discussion might have led to an alternative course of action to mitigate the risks associated with taking off from the dock.

Findings as to causes and contributing factors

1. The take-off length available on the dock was shorter than estimated. This, in combination with the reduction in take-off performance due to the effect of the dock depression, resulted in the landing gear striking the wooden safety curb.
2. The right main landing gear collapsed on landing as a result of damage incurred when the gear struck the wooden safety curb.

Findings as to risk

1. The COM's required discussion between the captain and the DFO or chief pilot did not take place. This discussion might have led to an alternative course of action to mitigate the risks associated with taking off from the dock.
2. The cockpit voice recorder (CVR) was not operating because of a faulty inertia switch. In a more serious accident, crucial investigation data and safety information could have been lost.
3. Failure of Technical Standard Order (TSO) C91-compliant Pointer emergency locator transmitter (ELT) mounting brackets (part number 2017) in an accident could cause a malfunction of the transmitter and prevent a timely and effective search and rescue response.

Other finding

1. If the actual take-off distance available had been what the captain had estimated (400 ft), the takeoff would likely have been successful.

Safety action taken

As a result of this accident, the operator has taken the following actions: ceased take-off operations from the dock; submitted a service difficulty report (SDR) on the faulty CVR inertial switch to Transport Canada; and removed the clip-type ELT mounting bracket and replaced it with the mounting bracket with the hold-down strap.

TSB Final Report A07C0082—Loss of Control—Collision with Terrain

On May 17, 2007, a float-equipped Cessna 180J was en route from Miller Lake, Ont., to Roderick Lake, Ont., returning from a series of camp re-supply and maintenance flights. The aircraft was reported as missing at 21:30 Central Daylight Time (CDT) when it did not arrive at Roderick Lake. Search and rescue personnel discovered the wreckage in a wooded area near the shoreline of Miller Lake. The pilot had sustained fatal injuries. The single passenger was trapped in the wreckage and had sustained serious injuries. The aircraft was substantially damaged.

Analysis

Damage to the aircraft was consistent with an impact with the ground after a low-level wing stall. The aircraft's exact flight path could not be determined. However, conditions were conducive for low-level wind shear at the time of the accident, and the aircraft was configured for takeoff or manoeuvring flight. A possible accident scenario is that the aircraft encountered wind shear while



manoeuvring in the vicinity of the operator's boat cache north of Miller Lake, resulting in a stall at an altitude from which the pilot could not recover.

The accident occurred at approximately 14:30 CDT. However, the aircraft was not reported as missing until 21:30 CDT because it was not expected to arrive at Roderick Lake until 20:00 CDT. Consequently, the flight watch system used by the camp operator and pilot delayed initiation of the search and rescue mission by seven hours. The late start, deteriorating weather, and the absence of an emergency locator transmitter (ELT) signal all contributed to a lengthy rescue mission, which extended the time that the passenger was trapped in the wreckage to approximately 18 hr.

Finding as to causes and contributing factors

1. The aircraft stalled while manoeuvring at an altitude from which recovery was not possible. The stall was most likely induced by low-level wind shear.

Findings as to risk

1. The company's flight watch system delayed the initiation of the search and rescue response.
2. The ELT had been turned off and was out of reach of the trapped passenger. The absence of an ELT signal compounded the difficulty in locating the aircraft and extended the duration of the search.

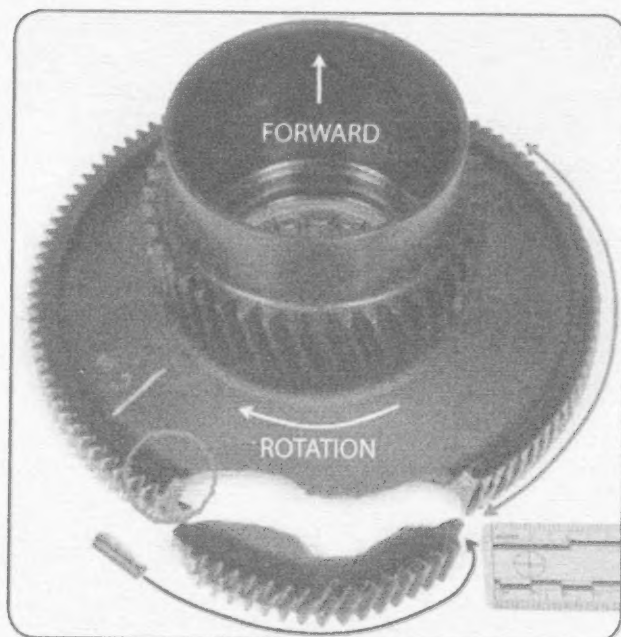
Safety action taken

After the accident, the operator purchased an aircraft satellite tracking system for its aircraft.

The operator implemented a procedure whereby a satellite telephone is carried on all camp maintenance flights and pilots are required to report flight-following information to the operator's dispatch personnel.

TSB Final Report A07A0056—Reduction Gearbox Failure

On June 3, 2007, a Bell 407 helicopter was en route to Postville, N.L., from the Jacques Lake drilling site, with the pilot as the sole occupant and an empty fuel tank weighing approximately 450 lbs on a 75-ft longline. At 500 ft above ground level (AGL), the engine chip light illuminated along with audible indications of an engine failure. Immediately after, there were two indications on the full authority digital engine control (FADEC): FADEC Fail and FADEC Degrade, followed by the audible engine-failure horn. Engine power output degraded and the pilot entered autorotation. At approximately 200 ft AGL, the pilot released the longline, landed in a bog, and exited the helicopter uninjured. The aircraft was undamaged, and there was minimal environmental impact. The incident occurred at 09:00 Atlantic Daylight Time (ADT).



Broken torquemeter gear

Finding as to causes and contributing factors

1. The helical torquemeter gear failed as a result of an undetected crack that progressed in fatigue. The failure of the torquemeter gear resulted in the loss of engine power to the helicopter's transmission.

Findings as to risk

1. In-service wear may cause torquemeter gear (part number 6893673) to wear prematurely.
2. Because it is not mandatory to replace torquemeter gear (part number 6893673) with the newly released torquemeter gear, it is possible that torquemeter

gear (part number 6893673) will experience premature wear and failure.

3. The Rolls-Royce 250-C47B Operation and Maintenance Manual inspection requirements allow the torquemeter gear and other gears installed in the gearbox to potentially exceed 3 500 hr in service before a magnetic particle inspection (MPI) is carried out.
4. The current visual and radius scribe inspections may be inadequate to detect cracks in the gear teeth.
5. The Rolls-Royce Operation and Maintenance Manual identifies the requirement for an MPI on the torquemeter gear and other gears in the gearbox based on their time in service. However, there is no requirement to track the time in service for any of these parts.

Safety action taken

On August 17, 2007, Rolls-Royce issued Commercial Engine Bulletin (CEB) 72-6061, which advised customers of the 250-C30 and 250-C47 series engines that the power gears (pinion gear, torquemeter gear, and power take-off gear) had been redesigned to improve the reliability of the new gears. The CEB stated that compliance was a customer option.

On March 26, 2008, Rolls-Royce advised that it was developing a visual inspection to be placed into the 2 000-hr inspection section in the Operation and Maintenance Manual. Implementation was targeted for the third quarter of 2008.

On July 11, 2008, Transport Canada issued Service Difficulty Alert AL 2008-01 regarding this issue.

TSB Final Report A07A0096—Engine Failure/Forced Landing

On August 27, 2007, a privately-operated Ayres S-2R spray plane was returning to the Boston Brook, N.B., airstrip after having completed the second spray-application flight of the day. The aircraft was at an altitude between 200 and 300 ft above ground level (AGL), approximately 2 NM from the airstrip, when the engine began to run rough. At approximately 08:13 Atlantic Daylight Time (ADT), the pilot contacted a company maintenance engineer by radio to report the problem. The engine then began to produce smoke and, eventually, it stopped running. A forced landing was carried out into a stand of trees at the edge of a cutover. The aircraft was substantially damaged, but the pilot escaped injury. There was no post-impact fire.



Aircraft's final position

Analysis

When the engine began to vibrate, the pilot attempted to identify and rectify the problem. He was not successful as there was very little time from the first indication of engine trouble to when the engine stopped completely. Under these circumstances, the pilot had no choice but to conduct a forced landing. The aircraft had only reached an altitude of approximately 200 to 300 ft AGL following completion of the spray task when the engine began to run rough. This left the pilot with little time to prepare for the forced approach or to select a more suitable landing area.

Examination of the engine showed that it contained sufficient lubricating oil and that the oil filter screens were free of metal particles or other contamination. This indicates that the engine was not making metal prior to the failure. Therefore, the imminent failure would not have been detectable during routine maintenance activity. Oil supply and engine maintenance were not a factor in the failure. The propeller, valve train, and accessory gearbox sections of the engine did not contribute to the engine failure.

The damage to cylinder No. 5 suggests that the associated connecting rod failed first in the sequence. It then penetrated the cylinder sleeve as the engine continued to operate. The failure initiated a chain of overload failures for each of the remaining connecting rods in rapid succession until the engine stopped operating. Due to the severity of damage to the fracture surfaces of connecting rod No. 5, the mode of failure could not be determined.

Findings as to causes and contributing factors

1. Connecting rod No. 5 failed for undetermined reasons. This failure initiated a sequence that resulted in the overload failure of the remaining connecting rods.

2. When the engine failed, the pilot had little time to prepare for the forced approach due to the low altitude of the aircraft.

TSB Final Report A07A0118—In-Flight Collision Between Two Helicopters

On October 3, 2007, a Bell 206 Long Ranger was taking off from a fuel-staging area south of Postville, N.L., at 10:00 Atlantic Daylight Time (ADT). At the same time, a Eurocopter AS 350 BA Astar was on approach to land at the same fuel-staging area. The Astar was carrying a sling load on a longline. During departure, the Bell 206L collided with the longline, causing the Bell 206L to break up in flight and crash near the shore of Kaipokok Bay, on the southern edge of Postville. The pilot, the sole occupant on board the Bell 206L, was fatally injured and the helicopter was destroyed. The pilot of the Astar maintained control of the helicopter and landed safely at the Postville airport; he was not injured, but the Astar sustained substantial damage.



Photograph of accident area

Analysis

The key to flight safety in the vicinity of uncontrolled airports is good radio communication and visual alertness. It is highly recommended that aircraft operating within an aerodrome traffic frequency (ATF) area follow the mandatory radio reporting procedures outlined in the *Canadian Aviation Regulations* (CARs) for operations within a mandatory frequency (MF) area. Use of these procedures is at the discretion of the aircraft operators while operating in an ATF area. Pilots have sole responsibility for seeing and avoiding other aircraft.

No broadcast was heard stating the Bell 206L pilot's intention to take off from the fuel-staging area. Had the Astar pilot known the Bell 206L was intending to take off, he could have possibly taken action in time to avoid a collision.

While positioned on the ground facing the fuel tanks, the Bell 206L pilot, who was seated on the right side of the aircraft, would have had difficulty seeing the Astar or the sling load approaching from above, behind, and to the left. A hover turn to the left prior to departure would have allowed the pilot to see the Astar and its sling load on approach. The reason for not executing this safety check to confirm that his intended flight path was clear of traffic is not known.

Although the Astar pilot made two position reports, it is probable that these broadcasts were not heard by the Bell 206L pilot. It is possible that the Bell 206L pilot had not yet donned his headset or that he had not yet powered the radios at the time the Astar pilot made his reports. The Astar pilot did not broadcast his aircraft's position when he was on final approach or on short final to the fuel-staging area. Despite the fact that the Astar pilot saw the Bell 206L rotors turning, and because the Bell 206L pilot had not broadcast his intentions to take off, the Astar pilot assumed he was not ready to take off or that he was shutting down. Also, the fact that the Bell 206L pilot had not responded to the Astar pilot's position report when he was 3 NM inbound would have indicated to the Astar pilot that the Bell 206L would not be a conflict.

Longline operations require a significant amount of attention from pilots, especially when flying in the vicinity of other objects or close to the ground. On short final, just prior to the collision, the Astar pilot's attention was on his sling load. He did not see the Bell 206L take off. Once he saw the Bell 206L appear in his floor sling window, he attempted a rapid climb. However, this evasive action was not successful in preventing the collision.

Although a potential risk had been identified with the high volume of traffic using the fuel-staging area, the radio reporting procedures were considered satisfactory by the various flight crews operating in the area. Prior to the occurrence, plans to move several fuel tanks to a different location had been discussed. The fuel-staging area was not congested at the time of the occurrence and traffic volume in the area was not considered to have contributed to the event.

Findings as to causes and contributing factors

1. No broadcast was heard stating the Bell 206L pilot's intention to take off and the Astar pilot was not aware that the Bell 206L was about to take off.
2. Although not mandatory to do so, the Bell 206L pilot did not execute a left hover turn prior to taking off to ensure there was no traffic or obstacles in his intended departure path. Without this safety check prior to takeoff, the Bell 206L pilot could not see the

Astar and its sling load coming from behind and from the left.

3. Although not mandatory, the Astar pilot did not broadcast his position on final approach or on short final.
4. It is likely that the Bell 206L pilot had not yet donned his headset or had not yet powered the radios and, therefore, did not hear either of the Astar pilot's previous position reports.

Finding as to risk

1. Uncontrolled airports pose an additional risk for users and although it is good airmanship to communicate on the published ATF, it is not mandatory by regulation to do so.

Safety action taken

Prior to this occurrence, the helicopter operators, the exploration companies, and the Postville town council had agreed to relocate several of the fuel tanks in order to alleviate the amount of traffic using the fuel-staging area. These plans were awaiting the appropriate permits. Since the occurrence, a new fuel-staging area has been prepared.

The operator briefed all of its crews working in the Postville area to increase the frequency of their position reports, to call on short final and to also call before departure.

TSB Final Report A08W0068—Loss of Control—In-Flight Breakup

On March 28, 2008, a privately operated Piper PA-46-350P Jetprop DLX had departed Edmonton, Alta., at about 07:33 Mountain Daylight Time (MDT) en route to Winnipeg, Man., on an IFR flight plan. Shortly after the aircraft levelled off at its cleared altitude of FL270, the aircraft was observed on radar climbing through FL274. When contacted by the controller, the pilot reported having autopilot and gyro-horizon problems and difficulty maintaining altitude. Subsequently, he transmitted that his gyro-horizon had toppled and could no longer be relied upon for controlling the aircraft.

The aircraft was observed on radar to make several heading and altitude changes before commencing a right turn and a steep descent, after which the radar target was lost. An emergency locator transmitter (ELT) signal was received by the Lloydminster, Alta., flight service station (FSS) for about 1½ min before it stopped. The wreckage was found by the Royal Canadian Mounted Police (RCMP) about 16 NM northeast of Wainwright, Alta., at about 12:05 MDT. None of the five people on board survived.



Findings as to causes and contributing factors

1. The gyro-horizon failed due to excessive wear on bearings and other components, resulting from a lack of maintenance and due to a vacuum system that was possibly not at minimum operating requirements for the instrument.
2. The gyro-horizon was reinstalled into the aircraft to complete the occurrence flight without the benefit of the recommended overhaul.
3. The autopilot became unusable when the attitude information from the gyro-horizon was disrupted.
4. The pilot had not practised partial panel instrument flying for a number of years, was not able to transition to a partial panel situation, and lost control of the aircraft while flying in instrument meteorological conditions (IMC).
5. The aircraft was loaded in excess of its certified gross weight and had a centre of gravity (C of G) that exceeded its aft limit. These two factors made the aircraft more difficult to handle due to an increase of the aircraft's pitch control sensitivity and a reduction of longitudinal stability.
6. The structural limitations of the aircraft were exceeded during the uncontrolled descent; this resulted in the in-flight breakup.
7. There were a number of deficiencies with the company's safety management system (SMS), in which the hazards should have been identified and the associated risks mitigated.
8. The company did not conduct an annual risk assessment as required by its SMS; this increased the risk that a hazard could go undetected.
9. The Canadian Business Aviation Association (CBAA) audit did not identify the risks in the company's operations. Δ

Reflections After an Accident

by Gerry Binnema. This article was originally published in the Nov.-Dec. 2009 issue of the Aviation News Journal (www.aviationnewsjournal.com) and is reprinted with permission.

A friend of mine died in a glider accident this spring. He was an amazing pilot and a really good guy. He used to fly jets in the CAF [Canadian Armed Forces] and then flew 747s for JAL [Japan Airlines]. He was an instructor out at the glider club, and I looked up to him because of his competence, confidence, and the excellent decision making that he displayed.

So what happened? A series of decisions, combined with poor conditions, led to him being just a little too low to return to the field. But it was really close. He could have landed in a small field a few miles away from the airport, but that would have resulted in damage to his brand-new glider, and it would have taken hours to retrieve his glider out of that field. Instead, he headed for a downwind straight-in landing at the airport, hoping for just a little lift on the way. What would you have done?

I know what you just answered. You would have taken the safe route. I would answer the same way. But research has shown that when we are actually in these predicaments,

we often don't take the safe and sure route. Instead, we often gamble.

Let me give you a less dramatic scenario, and I want to encourage you to be honest with yourself about how you would respond. You are driving down an unfamiliar road. You passed a small town about 20 minutes ago, but since then, you have not seen any sign of civilization. You have no idea about what is coming up next or how far it is to the next town. Suddenly, the little fuel light comes on. You have about 30 minutes of highway driving until your car runs out of gas. What will you do? To be safe and sure, you would need to turn back, but how powerful is the motivation to press on. There should be another station up ahead!

As humans, we hate to lose. So it is very difficult for us to make a decision that we know will result in a loss.

- We hate to turn back for gas when it means losing an hour of our time.
- We hate to cancel a flight when it means losing face or losing a customer.

- We hate to commit to a precautionary landing when we know it will mean damage, not to mention a huge hassle to get the aircraft out of a farmer's field. So to avoid the known loss, we are often tempted to take a risk.
- There should be a gas station just ahead.
- The weather for the trip isn't that bad, and we could always turn back if things turn out badly.
- I can probably make it back to the airport.

What we fail to do is look at the probability and severity of a bad outcome to the risk that we are taking.

One of the most studied decisions in recent history was the decision to launch the space shuttle Challenger on a cold January morning. That decision was exactly like the ones above. Cancelling the launch would have meant a huge loss to the shuttle program and a loss of face for the NASA [National Aeronautics and Space Administration] directors. When they asked the engineers about the risks of launching, no one could give them a clear, unequivocal answer. So they chose to avoid the known loss by taking a risk.

Of course, in hindsight, we now know that the Challenger launch decision was a bad one. And I now know that my friend made a bad decision on his flight this spring. But tomorrow, you or I might be faced with another similar decision. So how do we avoid making that bad decision?

First, we need to recognize this tendency and catch ourselves when we are in these situations. That isn't easy. We make these kinds of decisions instinctively, and it takes work to recognize them. But we make these kinds of decisions in small ways all of the time, so start recognizing the little things you do, as practice. Next time you are exceeding the speed limit while driving, ask yourself why. The answer will probably be that you are trying to avoid being late for something by taking the risk of a speeding ticket. Next time you are doing home maintenance and are using a tool improperly or using a ladder that is too short, ask yourself why. The answer will probably be that you are

trying to avoid the hassle of purchasing the right tool by taking the risk of personal injury.


Once you start recognizing your pattern for making these decisions, you need to give some deliberate thought to the risks. What are we afraid of losing?

- An hour's driving time
- A revenue flight
- An insurance deductible and a great deal of time

What risk are we considering taking to avoid this loss?

- Reasonable probability of running out of gas in the middle of nowhere
- Reasonable probability of flight into IMC [instrument meteorological conditions], leading to a possible fatal accident
- High probability of a forced landing in an unsuitable area with unknown survivability

Once we consciously consider the alternatives, we often see things in a different light. Normally, our focus is on avoiding the known loss and not on the risks we are taking. When we start looking realistically at the risks, we can improve our decision making. Start practicing today to avoid making a really bad decision the next time you fly.

Gerry Binnema is an aviation consultant with an airline transport pilot licence (ATPL), an aircraft maintenance engineer (AME) licence, and a Master's degree in System Safety and Human Factors. He has taught countless crew resource management (CRM), pilot decision making (PDM), and human performance in aviation maintenance (HPLAM) courses and is well versed in the safety management system (SMS) regulations. Gerry worked for several years as an aircraft accident investigator and as a Transport Canada (TC) system safety specialist. Gerry is also the author of TC's "Pilot Decision-Making Simulator", which can be found at www.tc.gc.ca/eng/civilaviation/regserv/safetyintelligence-airtaxistudy-simulation-decision_simulator-497.htm. He is deeply committed to saving lives through accident prevention. He helps companies with human-factors training and SMS development. For more information, please visit www.gjbconsulting.com. 

Accident synopsis A09Q0126 in ASL 2/2010: comments submitted by pilot

In the "Accident Synopses" section of ASL 2/2010, the narrative of occurrence A09Q0126 (on page 27) ended with the following statement: *Only the pilot/owner was wearing a seat belt.* The pilot involved in the incident submitted additional comments and asked that we clarify the narrative. According to him, both he and his passenger were strapped-in by four-point harnesses, and were also wearing inflatable life vests. The life vests were very effective in minimizing their upper body injuries in that they provided extra padding against the shoulder straps as they hit the ground nose first after falling about 65 ft from the tree-tops.

ACCIDENT SYNOPSES

Note: The following accident synopses are Transportation Safety Board of Canada (TSB) Class 5 events, which occurred between November 1, 2009, and January 31, 2010. These occurrences do not meet the criteria of classes 1 through 4, and are recorded by the TSB for possible safety analysis, statistical reporting, or archival purposes. The narratives may have been updated by the TSB since publication. For more information on any individual event, please contact the TSB.

— On November 6, 2009, an amateur-built Hummelbird was conducting a VFR flight from Trois-Rivières, Que., to St-Frédéric, Que. During the landing run on Runway 23, the aircraft struck a runway light and ended up in the ditch on the left-hand side of the runway. The pilot, who was alone on board, was not injured. The propeller, the propeller spinner, and the lower right wing skin were damaged. A 5- to 8-kt wind was coming from the right. *TSB File A09Q0189.*

— On November 8, 2009, a North Wing Design Maverick ultralight was on initial climb out from the Vanderhoof, B.C., airport when the aircraft was upset by a strong gust of wind. The ultralight's altitude could not be maintained and the tail section impacted a tree. It subsequently lost directional control, came down below power lines, and impacted the ground heavily. The aircraft was substantially damaged. The pilot suffered a broken leg. *TSB File A09P0380.*

— On November 12, 2009, a Robinson R44 II helicopter with the pilot and two passengers on board was conducting a VFR flight from Baie-Comeau, Que., to Baie-Trinité, Que. During the return flight, at approximately 12:49 Eastern Standard Time (EST), the aircraft struck a power transmission line's overhead ground wire, which crossed the Franquelin River, Que. The aircraft crashed in the river, which is located east of Baie-Comeau. The aircraft sustained substantial damage. The pilot sustained fatal injuries and the two passengers were transported to hospital to be treated for serious injuries. Two TSB investigators were sent to the accident site. *TSB File A09Q0190.*

— On November 13, 2009, a float-equipped Bell 206B was taking off from Lac du Bonnet, Man. The flight was a local training flight and the pilot was demonstrating a no-hover takeoff with floats. As the helicopter accelerated on the water, the right float reportedly dug in and the rotor blades contacted the water and separated. The helicopter remained upright on the water and there were no injuries. The company indicated that the floats may have lost pressure in the cold water, causing the float to dig in. *TSB File A09C0176.*

— On November 15, 2009, the pilot-owner of an Aeronca Champ had just finished fuelling the aircraft in preparation for departure from Brampton, Ont. To start the engine, the pilot used the hand prop method and was assisted by another person, who was holding the tail. When the engine started, it developed too much thrust for the person

holding the tail to control, and it broke free of his grasp. The aircraft struck a light standard and a large ladder that was a short distance ahead, and came to a rest with significant damage to the propeller, wing tip and leading edge. There were no injuries. *TSB File A09O0244.*

— On December 1, 2009, a Quad City Challenger II ultralight took off from Pitt Meadows, B.C., for a VFR flight to Salmon Arm, B.C. The aircraft ran out of fuel and the pilot made a forced landing in a field 4 NM west of Salmon Arm. The pilot obtained fuel and took off to complete his flight to Salmon Arm. By this time, darkness had fallen and the aircraft crashed near the button of Runway 14 at Salmon Arm. The aircraft was substantially damaged and the pilot sustained serious injuries. *TSB File A09P0398.*

— On December 13, 2009, a Canadian-registered Airbus A310-300 was being ground-run by maintenance personnel from a contracted overhaul facility in Rio de Janeiro, Brazil, following a "C" check. During the run-up, the aircraft jumped its chocks. The aircraft travelled across the apron area, across a road, and into soft, forested grounds. Both wings hit lamp standards resulting in damage to the leading edge slats. The engine nose cowls were damaged when hitting trees. The main bogies sustained damage and the nose gear was embedded in soft ground and was likely damaged. During the run-up, the circuit breakers [L/G PROX DET SYST 1 (1GB)/FLT GND and L/G PROX DET SYST 2/FLT GND (119GB)] were improperly pulled during the flight idle power testing. Pulling these circuit breakers inhibits both the nose wheel steering and the engine thrust reverser system. Furthermore, this action causes the brake and steering control unit (BSCU) to send an electronic signal to the anti-skid system to release all eight wheel brakes. *TSB File A09F0176.*

— On December 14, 2009, a Cessna 172 was conducting touch-and-goes at Mascouche, Que., to qualify for a night rating. The pilot had already conducted five circuits and during the last landing on Runway 11, he lost directional control of the aircraft. The aircraft slid to the left and hit a snowbank on the edge of the field. The propeller was twisted and the two wing tips were damaged. The pilot was not injured. While the aircraft was being recovered, it was found that the runway, which had been damp during the first landings at the beginning of the night, had frozen and become covered in black ice. *TSB File A09Q0209.*

— On December 17, 2009, a privately owned Piper PA-30 Twin Comanche was on a VFR flight from a private strip near Delhi, Ont., to Buttonville, Ont. On approach into Buttonville, the pilot could not get the landing gear to extend, so he elected to return to Delhi to land on the grass strip. The pilot attempted a manual gear extension; however, it was unsuccessful. The aircraft landed with all landing gear retracted and suffered damage to the aircraft skin and both propellers. Both occupants were uninjured. Initial inspection by an aircraft maintenance engineer (AME) revealed that one of the push-pull cables had seized. *TSB File A09O0270.*

— On December 22, 2009, a Beech E90 had touched down on Runway 18 at Winnipeg, Man., on a MEDEVAC flight from St. Theresa Point, Man. The landing gear selector was inadvertently selected up when an attempt was made to raise the flaps immediately after touchdown. The ground/air safety switch was not yet in the ground position and all three gears cycled up. The aircraft settled onto the runway and was substantially damaged. There were no injuries. *TSB File A09C0191.*

— On January 5, 2010, a Bell 206L-1 helicopter was engaged in heli-skiing operations in the Bobbie Burns area, 20 NM from Golden, B.C. While approaching a landing area at Roller Coaster Run, the helicopter was suddenly engulfed in a whiteout, the main rotor blades contacted the ground and the helicopter was substantially damaged. The pilot and one passenger sustained minor injuries, one passenger was uninjured. There was no fire. *TSB File A10P0004.*

— On January 11, 2010, a Piper PA31-350 aircraft was on final approach into Bloodvein River, Man., on a flight from Pikangikum, Ont. The aircraft landed on Runway 18 with the landing gear retracted. The aircraft came to a stop in the middle of the runway; the runway was then closed. There

were no injuries and the aircraft sustained substantial damage. *TSB File A10C0004.*

— On January 18, 2010, the pilot of a Cessna 172H took off from Nelson, B.C., for a VFR flight to Trail, B.C. Weather in the area included low cloud and fog. The aircraft struck mountainous terrain about 5 NM south of Nelson and was substantially damaged. There was a post-crash fire; however, the 406 MHz emergency locator transmitter (ELT) worked long enough to be picked up by an overflying aircraft and satellite. The pilot was injured and had extricated himself from the aircraft. He contacted the police on his cell phone, but was uncertain of his exact location. The crash site was located about 5 hr after the crash, but the pilot was deceased. *TSB File A10P0014.*

— On January 22, 2010, a Cessna 310Q departed Mascouche, Que., bound for Lachute, Que. While on approach for Lachute, the two engines (Teledyne Continental IO-470-VO) stopped. An emergency landing was conducted in a wooded area, 0.3 mi. from the threshold of Runway 10. The pilot was seriously injured; however, the instructor was not. Two TSB investigators went to the accident site. *TSB File A10Q0007.*

— On January 23, 2010, a privately operated wheel- and ski-equipped Maule (M-4-210C) was conducting a VFR flight from Blanc Lake, located 2 NM west of St-Donat, Que., to Lake Raymond, in Val-Morin, Que. After landing, the aircraft struck some hydro wires between an island and the lake shore, and then crashed on the frozen surface of the lake. The pilot, who was alone on board, was wearing his shoulder harness and was seriously injured. The aircraft sustained substantial damage, but there was no post-impact fire. *TSB File A10Q0008. Δ*

Reminder: Aviation Document Booklet Application

Your Transport Canada regional licensing office is now accepting Aviation Document Booklet applications for all licence and permit types.

Existing licence or permit holders who have not yet submitted an application to replace their licence or permit with the Aviation Document Booklet are strongly encouraged to submit their applications for the new Aviation Document Booklet as soon as possible. All licences and permits in the old format will expire this year.



Licence or permit holders must replace their current licences or permits with an Aviation Document Booklet this year or they will not be allowed to exercise the privileges of their licence or permit after the new regulations come into effect. Please see the Transport Canada Flight Crew Licensing Web site for more information:

www.tc.gc.ca/eng/civilaviation/standards/general-personnel-changes-3419.htm.



REGULATIONS AND YOU

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The 10 Most Commonly Contravened Regulations

by Jean-François Mathieu, LL.B., Chief, Aviation Enforcement, Standards, Civil Aviation, Transport Canada

Legislative provisions may be enabling, administrative, informative or offence-creating. Only the latter—offence-creating provisions—can be subject to enforcement actions. There are two types of offence-creating provisions: those that mandate a certain form of conduct and those that prohibit certain conduct. Offence-creating provisions are easy to recognize because they contain words such as “no person shall”, “an operator shall”, and “the pilot-in-command shall”. Non-compliance with these provisions is a violation that can result in judicial or administrative enforcement action.

There are two types of deterrent actions: judicial and administrative. Judicial action involves the prosecution of an alleged offender in the criminal courts and is applicable to only a few provisions of the *Aeronautics Act* and the *Canadian Aviation Regulations* (CARs). Administrative penalties are the measures that may be assessed by the Minister pursuant to the provisions of the *Aeronautics Act* and include assessment of monetary penalties and the suspension of documents. There are over 1 200 offence-creating provisions in the CARs, the violation of which can result in an administrative penalty.

The Aviation Enforcement Division conducts over 2 000 investigations annually, some of which result in penalties being issued to individuals and corporations in the aviation community. Over the years, the Aviation Enforcement Division has noticed that only a few of these offence-creating provisions are contravened on a regular basis. Knowing which regulations are contravened most often may increase awareness of the regulations and the risks associated with them, motivating individuals and corporations to avoid these violations and sometimes-costly penalties in the future. The 10 most frequently contravened regulations, in descending order, are as follows:

1. CAR 602.31(1): failure of the PIC
 - (a) to comply with an acknowledge ATC instructions directed to and received by the PIC,
 - (b) to comply with clearances received and accepted by the PIC
2. CAR 602.01: to operate an aircraft in a reckless or negligent manner
3. CAR 605.03(1): to take-off when
 - (a) flight authority is not valid,
 - (b) the conditions set out in flight authority have not been met and
 - (c) flight authority is not carried on board
4. CAR 602.14(2): to operate an aircraft
 - (a) over built-up area/open-air assembly of people at less than the specified height,
 - (b) elsewhere at a distance of less than 500 ft from an object/person
5. CAR 606.02(8): to operate a private aircraft without prescribed liability insurance
6. CAR 601.04(2): to operate in Class “F” Special-Use Restricted airspace without authorization
7. CAR 605.94(1): failure of the responsible person to make specified entries in the journey log
8. CAR 700.02(1): to operate an air transport service without an air operator certificate (AOC)
9. CAR 602.96(3): failure of PIC operating at/in the vicinity of an aerodrome to:
 - (a) observe traffic to avoid collision,
 - (b) conform with/avoid pattern of other aircraft,
 - (c) make all turns to the left unless specific in CFS or by ATC,
 - (d) comply with any airport operating restrictions specified in CFS,
 - (e) land/take-off into wind,
 - (f) maintain continuous listening watch on appropriate frequencies/keep watch for visual signals,
 - (g) obtain clearance to taxi, take-off and land when aerodrome is controlled
10. CAR 601.08(1): to enter Class C airspace VFR without having received a clearance prior to entering

Another available option of deterrent action is “oral counselling”. When Civil Aviation safety inspectors detect a violation, they are to exercise their delegated authority to make decisions with respect to the contravention. All available facts should be considered in order to determine whether oral counselling would be appropriate to promote compliance from the alleged offender in the

future. This action may be used to provide the alleged offender with the knowledge required for future compliance.

Where violations may have a more serious impact on safety, they will be addressed either by the assessment of a monetary penalty or by suspension of the offender's Canadian aviation document (CAD). Suspension of the CAD is appropriate when a monetary penalty is considered insufficient to achieve compliance or the document holder is a repeat offender against whom monetary penalties have previously been assessed.

Flying The Falls—CYR 518

by Mike Treskin, Civil Aviation Safety Inspector, Transport Canada, Ontario Region

Transport Canada (TC) has noticed an alarming number of aircraft not following the recommended visual flight rules (VFR) procedure in CYR 518, a restricted area located in the vicinity of Niagara Falls, Ont., and outlined by a chart in the *Canada Flight Supplement* (CFS). CYR 518 is located over the Canadian side of the Niagara River, overlaying the Falls. The zone extends from the ground up to but not including 3 500 ft above sea level (ASL)—approximately 3 000 ft above ground level (AGL). A racetrack pattern is published for all air traffic wanting to fly above (at or over 3 500 ft) the restricted area and view the Falls.

There are two entry points and two exit points that are clearly marked on the chart. Many fixed- and rotary-wing commercial operators fly inside CYR 518 with authorization from TC to transport sightseeing passengers to view the Falls. These operators all have pre-established flight paths and altitudes that they must follow to operate in a safe manner. There is an air-to-air frequency (122.050) on which advisory calls are made to ensure that everyone is on the same page. Calls should be made upon entry, indicating through which entrance point the aircraft is flying and its intentions (i.e. how many circuits it will complete, its speed, and more importantly, its altitude).


Probably the most important factor to remember is that this is a VFR procedure, which means that aircraft must "SEE AND BE SEEN". Pilots are responsible for their own separation. All pilots wanting to view the Falls must follow the recommended published circuit as accurately as they can and maintain a very good look-out for other aircraft at all times.

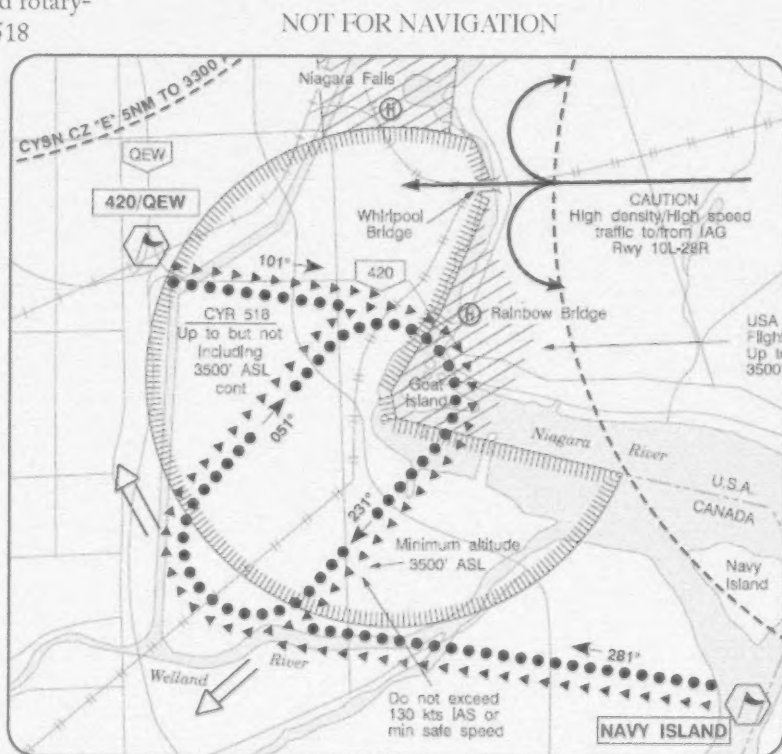
Some of these violations could have been avoided if individuals and corporations had a better understanding of the regulations and if pilots carried out proper flight-planning procedures, paid extra attention to detail, and used common sense and good airmanship.

The Aviation Enforcement Division encourages and promotes voluntary compliance with Canada's aeronautics legislation and is committed to enforcing the regulations in a fair and firm manner.

Have a safe flight! Δ

This procedure must be followed at 3 500 ft and above. Any dipping below 3 500 ft is an airspace violation and could result in TC enforcement action. It is highly recommended that pilots enter and exit at these recommended points even if they are coming in for a quick fly-by. Remember, this area is extremely congested with all sorts of aircraft, big and small. Pilots must keep their eyes open and remember to broadcast their intentions.

Most importantly, pilots should review attentively the recommended procedures for CYR 518 in the CFS *before* their flight, then enjoy the sights and colours of the Falls! 



Restricted area CYR 518 as depicted in the CFS. (Source: NAV CANADA)

Take 2 on Helicopter Helmets: Todd's Story

by Rob Freeman, Program Manager, Rotorcraft Standards, Operational Standards, Standards, Civil Aviation, Transport Canada

1980 was a watershed year for our company. Business literally took off. We finally got an instrument flight rules (IFR) operating certificate, as well as two large helicopters with an offshore oil contract to go with it. We also graduated a number of local students from our new flight school and were able to offer the best ones positions in our expanding visual flight rules (VFR) operations as soon as they received their licences.


Todd was one of that original group—a good-looking local kid in his early twenties, already engaged to a nice girl—who was fascinated with helicopters and showed lots of smarts and promise. He did well on the course, had been flying daily since graduation, and recently had been assigned to a base away from the head office. By early summer, he had already handled an engine deceleration in flight and plunked the float-equipped helicopter onto a pond, with no injuries to the passengers or himself, or damage to the aircraft. A couple of days later—after a review of the circumstances and his actions, and an “attaboy”—he was back in the air.

Several weeks later, when our owner requested a weekend fishing trip to his bush cabin, there was no hesitation to assign Todd to the task. It was to be a simple pick-up from a field by the hotel and a short, straight run of an hour or less to the camp. Onboard the helicopter were a number of regional business colleagues and friends of the owner. The operations manager co-ordinated the trip logistics, with the weekend dispatcher monitoring the flight progress.

It was a beautiful summer day, although—not unusually for the area—the winds were strong and quite gusty. Witnesses at the hotel watched the helicopter start and

climb out normally, and then turn west over the low hills into a generally uninhabited area. Shortly after the helicopter disappeared from sight, while still climbing, the engine failed suddenly due to oil coking causing bearing lubrication blockage and subsequent catastrophic turbine seizure. The terrain below was very unforgiving—the only immediate flat area was underneath high-tension lines. Todd attempted an autorotation to a railway cut to avoid the steep, rolling terrain. Stretching his glide to reach the one other level area in sight resulted in the loss of critical rotor RPM, and the helicopter hit hard, primarily on the right side. Some passengers were killed immediately in the crash, and all the rest onboard were badly injured. The owner, in spite of his own serious injuries, dragged himself clear of the wreckage and stumbled a considerable distance over rough terrain to get help. Todd's injuries were not serious—except for the one hard blow to his head caused by the door-frame during the impact sequence. In spite of a lot of prayers and tears, he died in hospital several days later.

Over the years, it has become increasingly apparent that there are no new accidents. We have to accept some risk if we want to defy gravity. However, in pursuing the holy grail of absolute safety, we should not overlook the simple, obvious mitigants to the severity of these accidents. Wearing a helmet whenever you fly is one of those mitigants. Any off-the-shelf technology that has been shown to significantly reduce injury statistics should be embraced by all concerned.

If you have any lingering doubts, think of Todd and that simple, recreational flight on a beautiful summer's day. 

TC AIM Snapshot—Language

The use of English and French for aeronautical radio communications in Canada is detailed in sections 602.133, 602.134, and 602.135 of the CARs. The regulations specify that air traffic services shall be provided in English and sets out the locations where services shall be provided in French as well. The tables containing the names of those locations, as well as the pertinent section of the CARs are contained in COM Annex A.

For safety and operational efficiency, once the language to be used has been determined, the pilot should refrain from changing language in the course of communications without formal notification to that effect. In addition, pilots should endeavour to become thoroughly familiar with the aeronautical phraseology and terminology applicable to the type of service being provided in the official language of their choice.

(Ref: Transport Canada Aeronautical Information Manual [TC AIM], section COM 5.2)



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FLYING ON BOARD SEAPLANES/FLOATPLANES

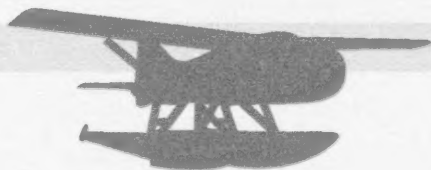
Be prepared!

Familiarize yourself with these matters before your flight:

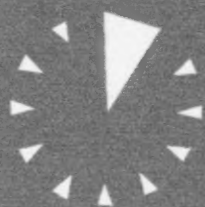
- Baggage limits and stowage locations
- Seat belt operation
- Securing of seat backs and table trays
- Situational awareness
- Exit locations and operation
- Safety briefing card (always review before flight)
- Equipment—ELT, survival kit, first aid kit, fire extinguisher, oxygen
- Electronic devices
- Life preserver location and operation
- No smoking requirements
- Underwater egress

Pilots are required to provide a complete safety briefing before takeoff. Be sure all the above are covered. Ask questions if you are unsure about anything.

For more information, please visit www.tc.gc.ca/floatplanes.



Canada



TAKE FIVE...

for safety

Five minutes reading
could save a life

Underwater Egress

Although the odds of experiencing a ditching event are extremely low, pre-flight preparation and knowledge are paramount to survival should it happen.

The following items will enhance your chance of a successful egress.

1. Pre-flight Preparation

Ensure the pilot-in-command demonstrates the location and use of the emergency exits, life preservers, emergency equipment, life raft, and the proper brace position—before the flight. For extended over-water flights, consider wearing your life preserver. Make sure all baggage and cargo is secured so it does not block access to the emergency exits.

2. In-flight Preparation

If you are aware that you are about to ditch, do the following:

- Put on your life preserver, but **DO NOT INFLATE IT**.
- Locate all emergency exits, note where they are in relation to your right or left hand, and visualize how to open them.
- Assume the proper brace position for your seat, as briefed by the crew.
- Follow the instructions given by the pilot-in-command.

3. Underwater Egress Procedure

- **Try to remain calm!**
- Take a deep breath prior to being submersed under water.

- **OPEN YOUR EYES.**
- Orient yourself in relation to your selected emergency exit.
- Get a firm grip on a fixed reference point.
- *If you are seated right next to your emergency exit:*
 - Wait until the water has filled three quarters of the cabin before you fully open the exit, then open it.
 - Release your safety harness.
 - Pull yourself free from the cabin.
 - Inflate your life preserver after exiting the aircraft.
- *If you are NOT seated right next to the emergency exit:*
 - Release your safety harness and proceed toward your emergency exit.
 - Wait until the water has filled three quarters of the cabin before you fully open the exit, then open it.
 - Pull yourself free from the cabin.
 - Inflate your life preserver after exiting the aircraft.

Some of the difficulties during underwater egress include lack of oxygen; disorientation; in-rushing water; obscured vision; and floating debris.

Don't panic. You know you can hold your breath, so relax for a moment; open your eyes; find the exit; and egress. These are basic guidelines only, and your best defence is underwater egress training.